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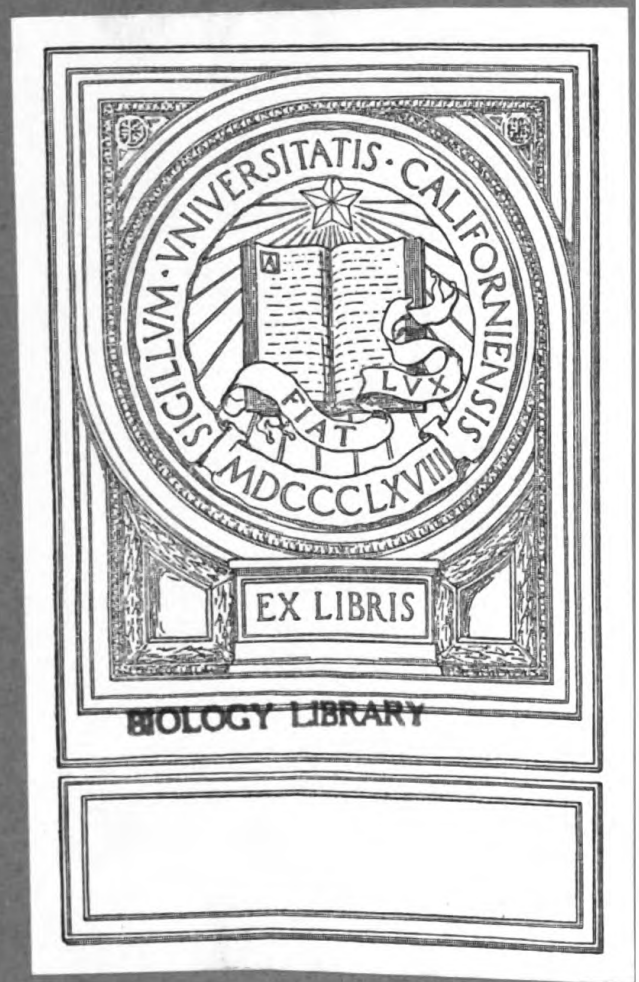


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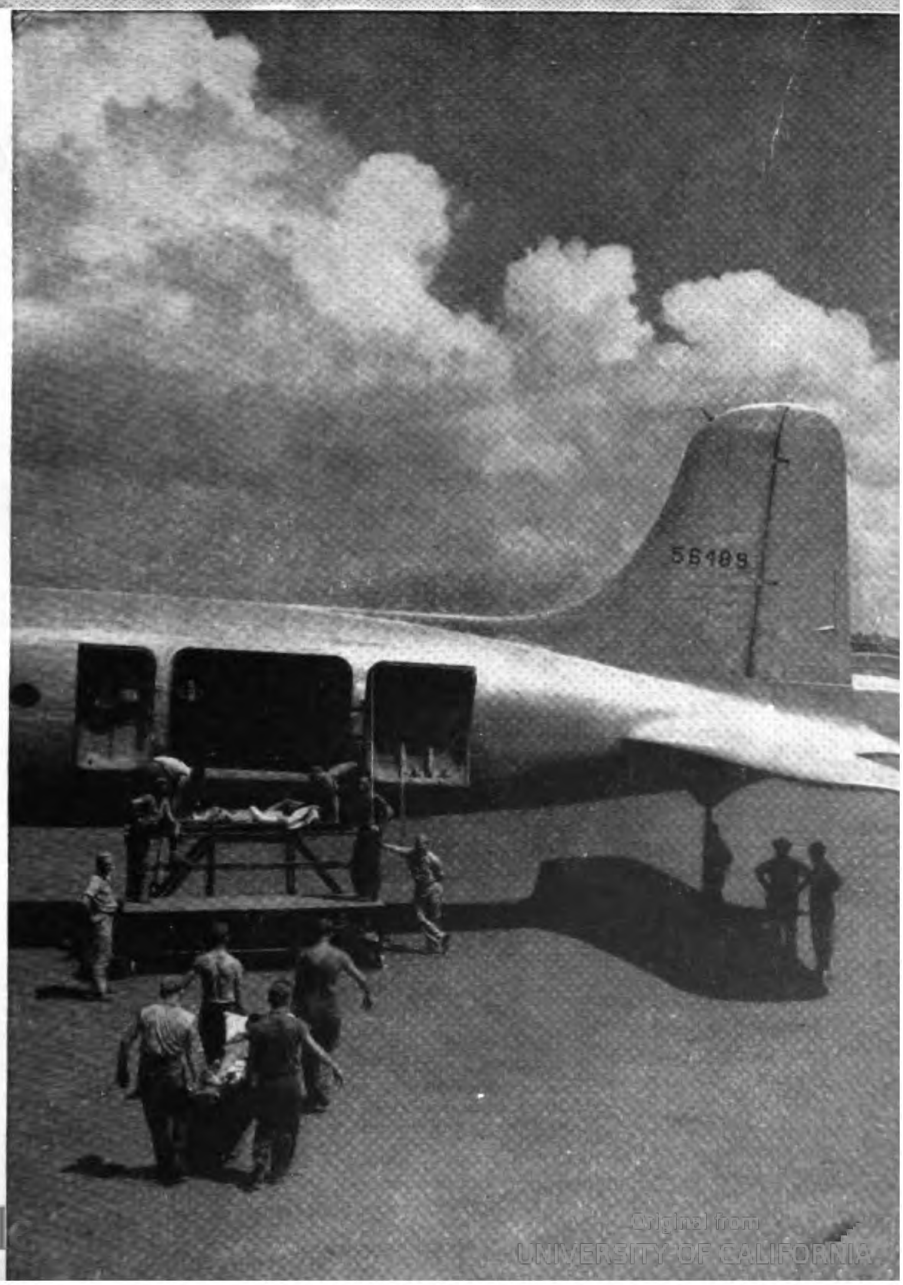
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JANUARY 1946

BUREAU OF
DICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

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COVER PHOTOGRAPH

Nature provides a peaceful backdrop as a giant Skymaster receives wounded men bound for hospital treatment in Hawaii or continental United States. The scene is Guam, important junction in the vast air evacuation network developed by the Navy in the Pacific. In the closing months of the war, thousands of casualties were transported by air from Okinawa to Guam and thence to Hawaii and the mainland.

—Official U. S. Navy Photo.

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VOL. 46 JANUARY 1946 NO. 1

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MONTHLY

DIVISION OF PUBLICATIONS
BUREAU OF MEDICINE AND SURGERY

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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

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PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

With the establishment of the Dental Corps in 1912, the function of the BULLETIN was broadened to serve in a similar capacity for members of that Corps.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

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NOTICE TO CONTRIBUTORS

Contributions to the BULLETIN should be typewritten, doubled-spaced, on plain paper and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication; for example, addresses and dates, not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in headings and captions.

Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustration, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized. Recognizable photographs of patients should carry with them permission to publish.

All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

ROBERT C. RANSDELL, *Editor,*
Commander, Medical Corps,
United States Naval Reserve, Retired.

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U. S. NAVAL MEDICAL BULLETIN

VOL. 46 JANUARY 1946 NO. 1

SPECIAL ARTICLES

LEUKEMIA IN NAVAL PERSONNEL[1]

BRUCE L. CANAGA, JR.
Lieutenant Commander (MC) U.S.N.

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In the past 15 months at the U. S. Naval Hospital, Oakland, California a remarkably large number of cases of leukemia have appeared.

During this period 16 cases of leukemia were seen (table 2), 10 of them lymphocytic (only 2 of the cases were of the chronic variety, the balance were classified as acute or subacute), 4 myelogenous, 1 monoblastic, and 1 leukemoid. These figures are significant when one refers to previous statistics on the incidence of leukemia in the entire Navy (*1*) as shown in table 1.

TABLE 1.—*New admissions from leukemia*

Year	Acute	Chronic
1940	1	1
1941	3	3
1942	13	16
1943	35	28
1944	54	24

[1] **Read before the California Medical Association, Section on Pathology and Bacteriology, Annual Meeting, Los Angeles, California, 7 May 1945.**

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From these figures it would appear that this hospital, with only a fraction of all Naval patients, has had an abnormally high percentage (approximately 20 percent) of the diagnosed and recorded cases.

TABLE 2.—*Cases of leukemia*

Name	Age	Type
C.F.T.	19	Lymphocytic, acute
F.J.C. (case 3)	20	Lymphocytic, aleukemic
E.N.B.	36	Lymphocytic, aleukemic
L.E.V.H.	19	Lymphocytic, acute
R.J.F. (case 2)	26	Lymphocytic, acute
E.T.A.S. (case 1)	20	Leukemoid (?)
R.T.G.	24	Myelogenous, chronic (acute exacerbation)
R.T.D. (case 4)	20	Myelogenous, aleukemic
F.J.C.	20	Lymphocytic, aleukemic
N.T.M.	60	Lymphocytic, chronic
E.L.W. (case 5)	26	Lymphocytic, aleukemic
L.A.B.	19	Lymphocytic, chronic
W.P.D.	24	Myelogenous, aleukemic
D.A.C.	31	Lymphocytic, acute
T.C.H. (case 6)	28	Monoblastic, acute
D.B.S.	29	Myelogenous, acute

Leukemia may conceivably be on the increase although there are no satisfactory statistics to establish this point.

Approximately 50 percent of the cases were readily diagnosed on the basis of the findings of stomatitis and gingivitis, a hemorrhagic tendency of greater or less severity, fever, variable degrees of splenic and lymph node enlargement, and abnormalities in the total number or morphologic appearance of the white blood cells. The remainder represented diagnostic problems of more than ordinary difficulty, some of which are peculiar to the Naval service and some to the character of the disease. Many of these patients had received their initial examination in ships' sickbays or advance base hospitals, and in some who arrived in this country from overseas, details of the examination were incomplete.

In certain instances the initial symptoms (fatigue, weight loss, and slight fever) were not regarded as particularly significant under the conditions of service, and diagnosis was accordingly delayed. In others, hemorrhagic features or the clinical aspects of an infectious process confused the picture. A history of previous sulfonamide therapy in certain cases seemed at first to explain an existing leukopenia. In the aleukemic or subleukemic cases, only an expert hematologist would have been able to make an early diagnosis on the basis of the original blood smears.

In the first case to be reported the clinical picture was that of subacute lymphatic leukemia. The terminal features of the disease and the necropsy findings were remarkable.

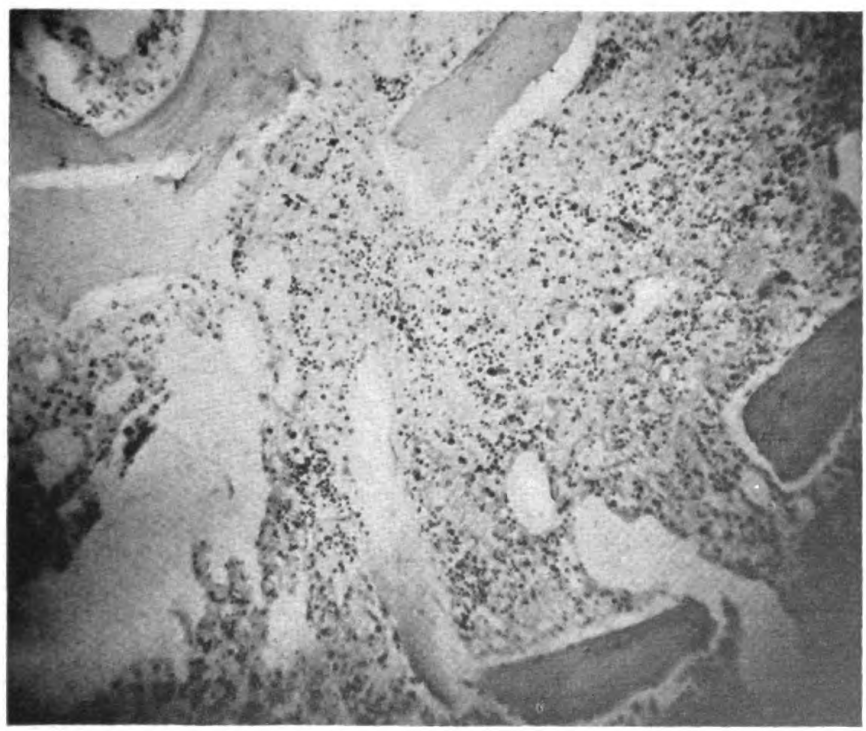
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CASE REPORTS

Case 1.—This 20-year-old patient first became ill in February 1944 with a cellulitis of the right leg. He then developed a series of superficial cutaneous infections which persisted for several weeks. At this time it was noted in his health record that his leukocyte count was 4,300 per cu. mm. of blood, with 64 percent lymphocytes, but no further comment was made regarding the morphology of these cells. Five months later he complained of sharp pains in the left upper quadrant of the abdomen, and for the first time his spleen could be palpated. The liver was not enlarged, and there was no generalized lymph glandular enlargement. At this time the leukocytes numbered 10,000 per cu. mm. of blood, with 85 percent lymphocytes. An occasional myelocyte was also seen. One month later his leukocyte count had risen to 24,000, with a predominance of immature cells which were not otherwise identified. He was transferred to this hospital via air in August 1944.

On admission here he appeared acutely ill. His liver, spleen and superficial lymph nodes were enlarged and easily palpable. He had developed an acute tonsillitis and pharyngitis en route. The leukocytes numbered 60,000 per cu. mm. of blood, with almost 100 percent lymphocytes, most of which were regarded as immature. The heterophil antibody reaction was not determined. Penicillin therapy was instituted in the hope of controlling the faucial infection as rapidly as possible, and it did improve the local condition materially.

After one week of treatment he developed a productive cough and hemoptysis. Roentgenographic studies of the chest showed a patchy infiltration suggestive either of a bronchopneumonia or leukemic infiltration. A few days later his complaints referable to the throat and chest had subsided and penicillin was discontinued. X-ray therapy was then started but was stopped when the leukocytes fell abruptly to 1,900 per cu. mm. of blood.



1. Sternal marrow (case 1). Note the marked aplasia of the marrow.

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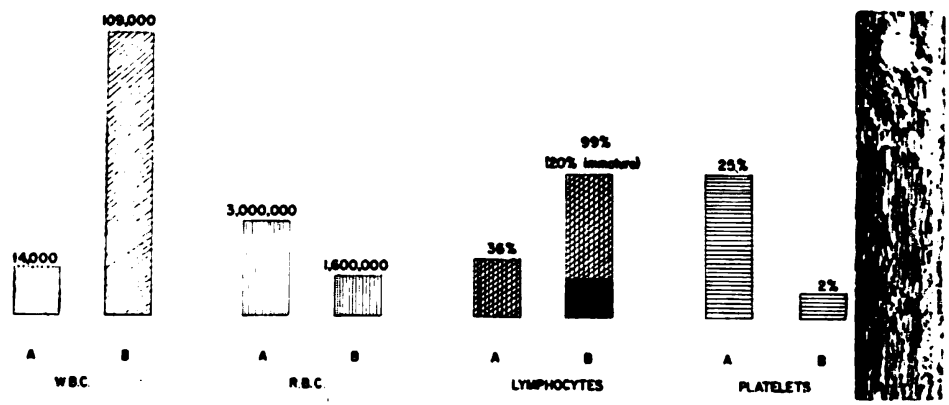
Early in October he again had severe abdominal cramps, and x-ray treatment was again instituted, but was discontinued when the leukocyte count fell rapidly to 950 per cu. mm. of blood. He became icteric, ascites developed, and hemorrhagic symptoms (hematuria) made their first appearance. The blood urea nitrogen rose to 141 milligrams per 100 cubic centimeters. He died 3 months after the onset of the disease, with symptoms suggesting uremic coma.

The findings on postmortem examination were surprising. Except for the peripheral blood picture, there was no anatomic evidence to support the diagnosis of leukemia. The bone marrow (fig. 1) was hypoplastic with only a few lymphocytes present. The architecture of the lymph nodes was normal. The spleen weighed 683 gm. and the malpighian bodies, instead of being large, were actually tiny and indistinct. There were no leukemic infiltrates in either the splenic pulp, the liver, or the lungs. Curiously enough, the renal tissue showed a considerable number of polymorphonuclear leukocytes as a component of a pyelonephritis which obviously was responsible for the terminal features of the illness.

The possibility of a leukemoid reaction to an infection or some previously administered therapeutic agent was considered, but in view of the consistent picture of an acute lymphocytic leukemia which existed in the peripheral blood, this idea was abandoned. A biopsy of sternal marrow or lymph node in the earlier stages of the disease might have shown an altogether different morphologic picture. It is also conceivable that the roentgen-ray therapy to which the patient had shown a high degree of sensitivity may have affected the usual collections of lymphocytes in the tissues without greatly altering the peripheral blood picture.

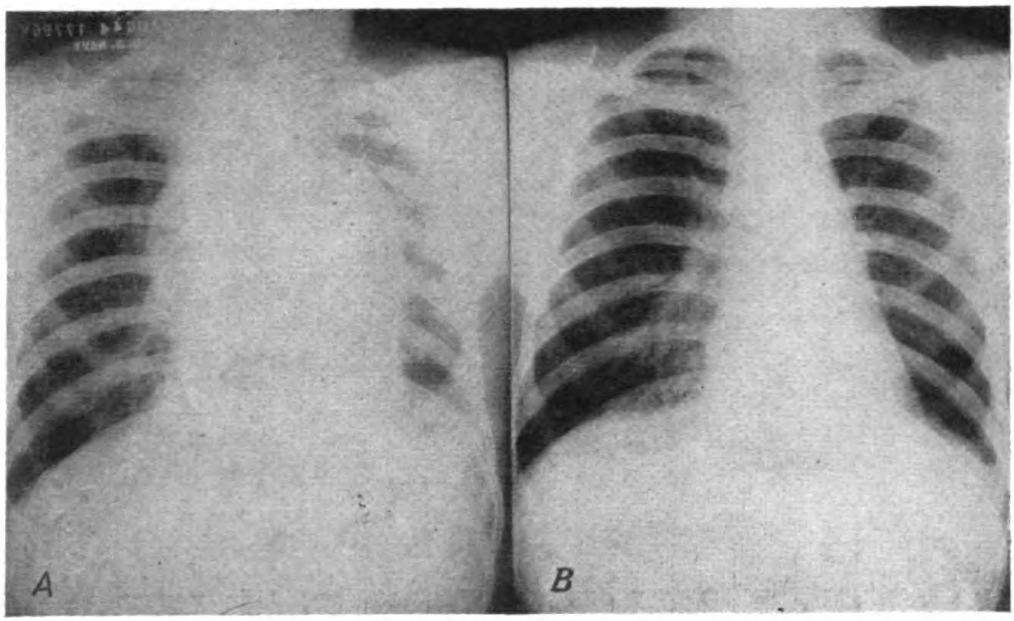
Somewhat the reverse of this situation was noted in the next case.

Case 2.—A 26-year-old serviceman sustained a gunshot wound of the left shoulder on Bougainville on 16 December 1943. He was returned to this hospital in March 1944. At the time of admission he was in good condition except for a paralysis of the left radial nerve.



2. Graphic representation of blood findings (case 2). (A) Immediately before starting x-ray therapy. (B) One month after x-ray therapy was begun.

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3. Roentgenographs of the chest (case 2). Compare with the peripheral blood picture, figure 2. (A) Immediately before starting x-ray therapy. (B) One month after x-ray therapy was begun.

Two months later he suddenly developed a productive cough and complained of chest pain. Fluoroscopy showed a mass in the upper mediastinum. The blood count revealed a mild anemia, and there were 14,000 leukocytes per cu. mm. of blood, with an essentially normal differential count. The mass in the chest increased in size, and the spleen became palpable. Despite the absence of adenopathy, it was thought to be a case of Hodgkin's disease. In September, x-ray therapy over the chest and spleen (figs. 2 and 3) was begun, with a most surprising effect on the leukocyte count, which immediately increased to 109,000 per cu. mm. of blood with a large predominance of lymphocytes and lymphoblasts.

The mass in the mediastinum decreased rapidly in size, but the patient did not improve and he became more anemic despite transfusions. Petechial hemorrhages appeared at various points, a large amount of dark blood was passed per rectum, and the patient expired on 2 October, only 4 weeks after the first known appearance of immature cells in the peripheral circulation.

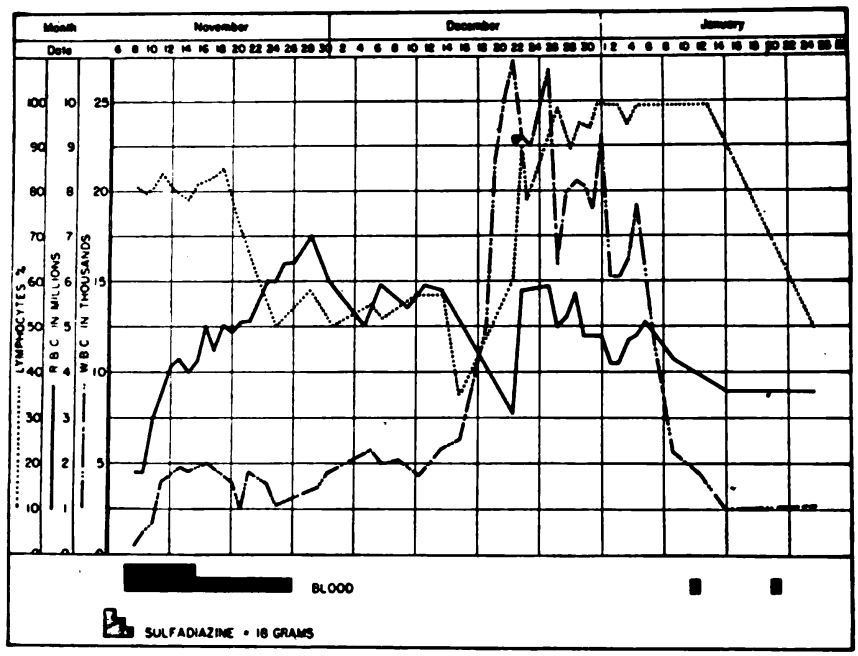
Postmortem examination disclosed a terminal hemorrhage into the bowel and peritoneal cavity—the result of a leukemic infiltration into the cecum. There was a generalized leukemic infiltration throughout the body, the extent suggesting that this was a chronic lymphatic leukemia with a recent acute exacerbation. In this patient, x-ray therapy was the factor initiating the appearance of the leukemic picture in the peripheral blood.

The next case to be considered was of unusual interest. The initial picture was that of pneumonia, with an agranulocytosis probably secondary to sulfadiazine therapy; it was only after prolonged observation and biopsy of the sternal marrow and a lymph node that a diagnosis of leukemia was established.

Case 3.—The patient, 20 years old, entered this hospital on 4 November

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1944, complaining of fever and weakness of 1 week's duration. For these symptoms he had received irregular doses of quinine without effect. On admission he appeared moderately ill and had a temperature of 104° Fahrenheit. The skin of his face and chest presented a livid discoloration suggestive of polycythemia. A few small nontender cervical nodes were palpable, but the liver and spleen were not felt at the initial examination.



4. Graphic representation of the peripheral blood picture (case 3). The rapid rise of the erythrocyte count was probably related to the numerous whole blood transfusions received.

Roentgenograph of the chest showed a partial consolidation of the middle lobe of the right lung. Because of the clinical picture of pneumonia, the patient was started on sulfadiazine therapy. Unfortunately an immediate leukocyte count was not done and the first information on this point was obtained 2 days later (fig. 4). At this time the erythrocyte count was 1,500,000, and the leukocyte count 350 per cu. mm. of blood. A differential count revealed only 62 cells in 3 smears, 20 of which were segmented varieties and 42 lymphocytes. Sulfadiazine was discontinued at once (only 18 gm. had been given), and he was placed on penicillin therapy. Liver extract, bone marrow concentrate, and numerous transfusions were given with much improvement.

Five weeks later the blood picture, except for an occasional lymphoblast in the peripheral blood, was normal. It was thought that the patient was well on his way to recovery from an acute sulfadiazine agranulocytosis, and all remaining therapy was stopped. Five days later the temperature rose to 101° F., a generalized lymphadenopathy developed, and the spleen became palpable 2 cm. below the left costal margin. The leukocyte count rose to 28,000, with a predominance of immature cells of the lymphocytic series. The erythrocyte count remained normal.

Biopsy was done on sternal marrow and an inguinal node. The bone marrow showed an extensive infiltration with cells of the lymphocytic series, while the lymph node showed a marked lymphoid hyperplasia with loss of normal

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architecture—the picture typical of lymphocytic leukemia. X-ray therapy was administered but from this point on the patient's course was steadily downhill. The leukocytes dropped to 2,200 per cu. mm., with 99 percent lymphocytes, and a mild anemia developed. The patient became acutely dyspneic, even though he was in an oxygen tent, and expired 3 months after the onset of the illness.

Necropsy in this patient was enlightening, for not only did he have an acute lymphocytic leukemia, but also a widespread and totally unsuspected tuberculosis. On microscopic section, numerous small tubercles with caseous centers containing acid-fast bacilli were found in all the tissues, including the bone marrow. The peribronchial and mediastinal nodes were completely replaced by large areas of caseation, and there was an extensive tuberculous pericarditis with effusion. Cardiac tamponade appeared to be the principle cause of death. The rapid dissemination of the tuberculosis apparently took place at the time of the greatest depression of the hematopoietic centers.

The next case was not correctly diagnosed clinically and was, in fact, regarded as an atypical Banti's syndrome. In retrospect it is clear that a more prolonged hematologic study, and a sternal biopsy would have established the diagnosis. It is remarkable that a splenic tumor of this size should have existed with so little change in the peripheral blood.

Case 4.—While this 20-year-old patient was on duty in the Hawaiian Islands in November 1944, he suddenly developed a fever of 104° Fahrenheit. He had no other symptoms at the time except for a feeling of fullness in the abdomen; he said he had had this sensation for 2 or 3 months. At that time physical examination disclosed no abnormalities except considerable enlargement of the spleen, a mild anemia, and a leukopenia (4,000 leukocytes per cu. mm., with a normal differential picture).

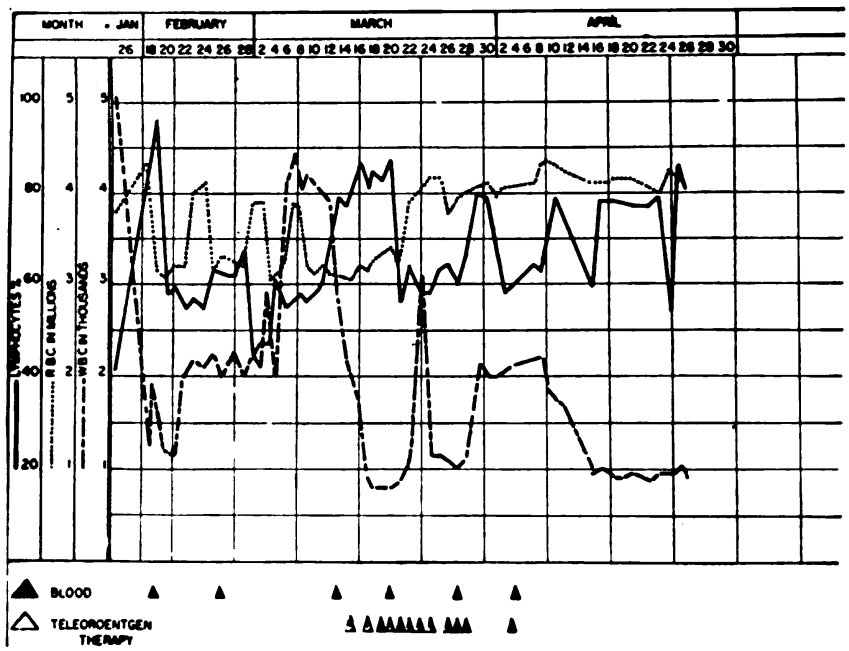
He was transferred to this hospital in December, at which time he was found to be moderately undernourished. There was a marked splenomegaly, but the blood picture was not considered remarkable. A peritoneoscopic examination was performed in January 1945. The spleen was found to fill the entire left half of the abdominal cavity, extending to the iliac crest and the midline. The liver was grossly enlarged, and there was a considerable amount of free blood in the peritoneal cavity. Following peritoneoscopy he was returned to the ward, and 2 hours later he suddenly went into shock. An emergency splenectomy, in the belief that splenic rupture had occurred, was then done, but he expired as the wound was being closed.

The full significance of this case was only appreciated at necropsy. The liver was enlarged, weighing 4,500 grams. The spleen was even larger, weighing over 5,000 grams. Microscopically, typical lesions of chronic myelogenous leukemia existed in the spleen, liver, and bone marrow. A belated review of the blood smears taken on admission showed occasional immature cells of the myeloid series, and it is possible that a diagnosis of leukemia might have been ventured from a more exhaustive examination of these slides. One wonders if x-ray therapy over the spleen would have brought out the leukemic picture seen in case 2.

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The following case was one which would have ordinarily been regarded as an example of agranulocytosis of unknown origin. There was a remarkable paucity of clinical findings and only a biopsy would have established the diagnosis. The bone lesions in the patient were of especial interest, since they rarely occur in this form in any type of leukemia.

Case 5.—A 20-year-old serviceman was admitted to this hospital on 19 January 1945, complaining of weakness over a period of 3 months. He was otherwise fairly well, and physical examination yielded only negative findings. The blood count showed a mild hypochromic anemia; the leukocyte count was 5,000 per cu. mm., with a normal differential picture (fig. 5).

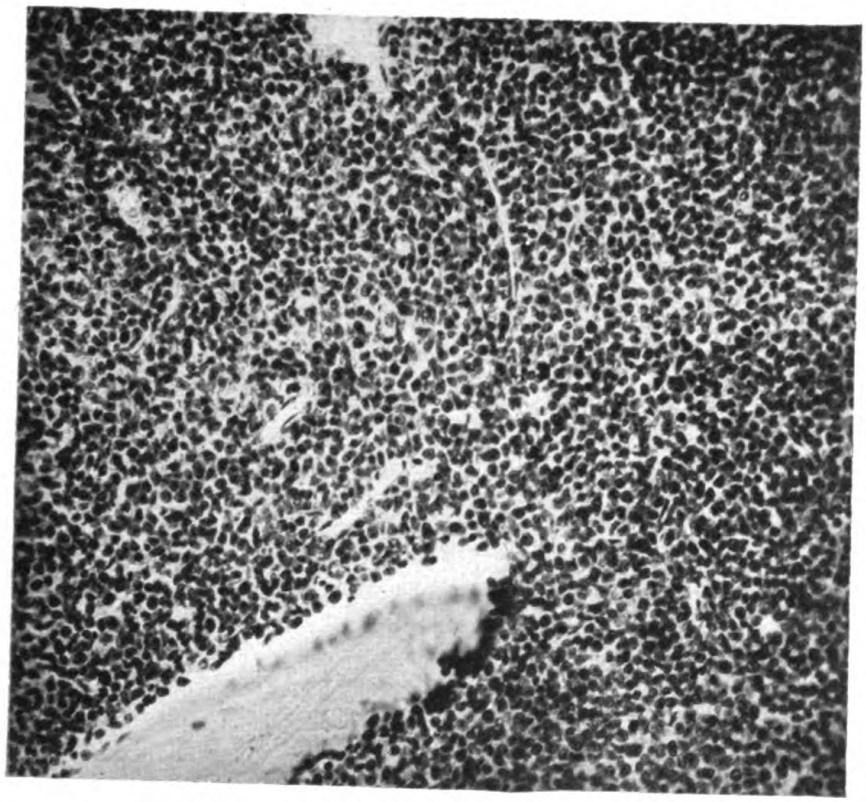


5. Graphic representation of the peripheral blood picture (case 5). This variable picture compares readily with figure 4 and indicated the necessity for repeated blood counts.

Because of his previous overseas assignment he was given 20-day leave. On returning he complained of continued fatigue and had lost some weight. At the second examination a generalized glandular enlargement was noted. The liver and spleen, however, were not palpable. A leukocyte count revealed 1,500 cells per cu. mm. of blood, with 84 percent lymphocytes.

A biopsy of the sternal marrow (fig. 6) and of a cervical lymph node showed an extensive infiltration with lymphocytes. The patient was started on a course of teleroentgentherapy, following which the leukocyte count fluctuated between 600 and 3,000 per cu. mm. of blood, averaging 1,000 cells. In April he began to complain of pain in both ankles. Although there was minimal swelling and little objective evidence of disease, the pain was so acute that he was unable to walk or stand. Roentgenographs (fig. 7) revealed considerable patchy demineralization, with interspersed linear areas of bone showing a destructive process, presumably of leukemic origin.

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6. (Above) Sternal biopsy (case 5). Compare with figure 1.



7. (Right) Roentgenogram of right ankle (case 5). The same picture was seen on the left.

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X-ray therapy, 400 r over the ankles, was given, following which he showed great improvement to the point where he was able to walk unassisted. The leukocytes fell to 900, the erythrocytes averaging about 3,000,000 per cu. mm. of blood. The differential picture continued to show the lymphocytic predominance previously mentioned. After a period, during which the patient's condition was unchanging, he expired in May 1945. During the last 3 weeks of life he developed a marked anemia, and the leukocyte count dropped to less than 500 per cu. mm. of blood. An extensive cellulitis involved the face and neck, he became icteric, and died with a rapidly extending pneumonic process in both lungs. Necropsy was not performed.

The following case is presented briefly because of its interest and because of the rarity of acute monocytic leukemia. This patient demonstrated the hepatomegaly so often seen in this particular type of leukemia.

Case 6.—This 28-year-old patient had been suddenly seized with sharp pains in his chest and back while on duty aboard a destroyer in the South Pacific. He was admitted to the sick list on 24 May 1945, and transferred ashore with a tentative diagnosis of infectious mononucleosis. The leukocytes numbered 26,000 per cu. mm. of blood. A few days later, at an advance base hospital, it was decided that he had an acute myelogenous leukemia. The leukocyte count at that time had risen to 108,000, and there was also a significant anemia and thrombocytopenia. He was transferred via air to this hospital on 10 June 1945.

On arrival he appeared acutely ill. He had lost much weight and the skin of his face showed numerous areas of leukemic infiltration, as well as petechial hemorrhages and small hematomas. The abdomen was tense and contained some free fluid. The liver and spleen were greatly enlarged, and over the abdominal wall sizable venous collateral channels were visible. There was also a moderate generalized lymphadenopathy.

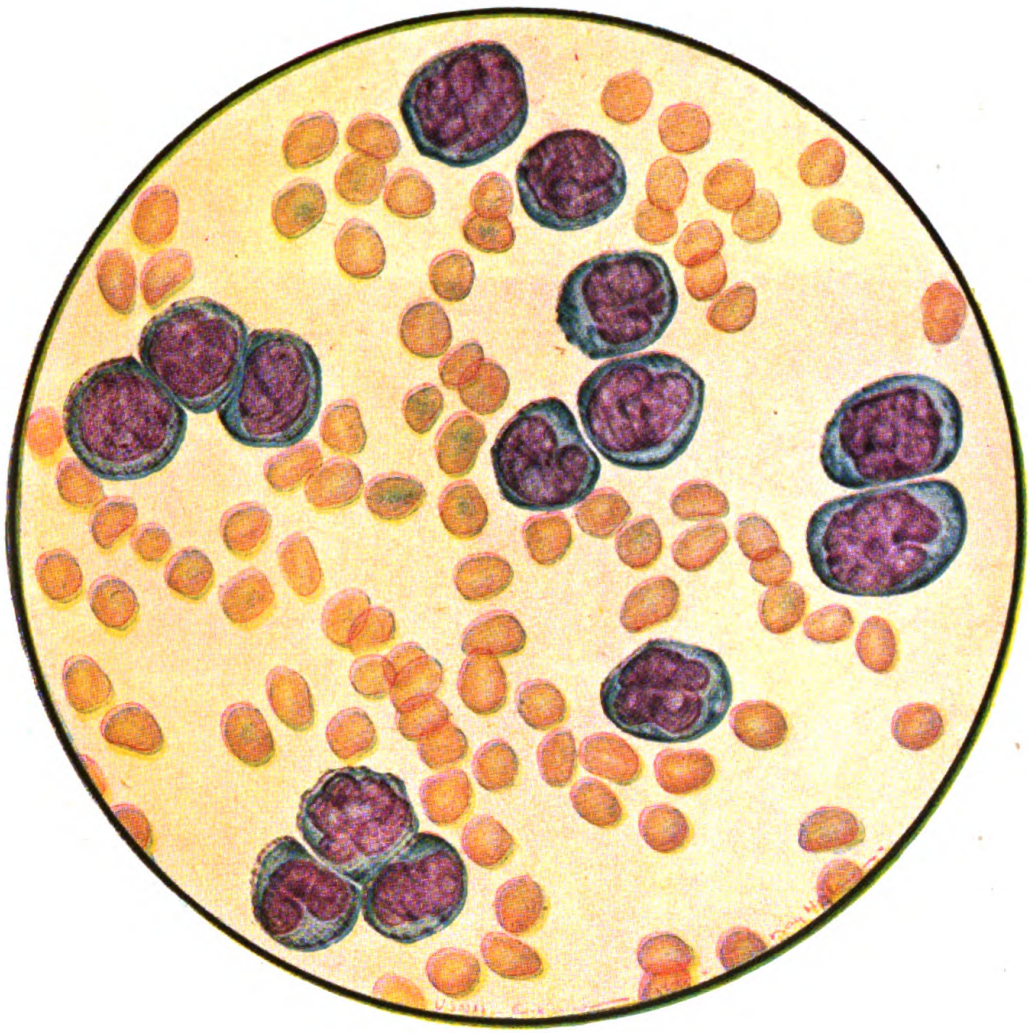
The leukocyte count had risen to 311,000. A stained smear (fig. 8) showed numerous monocytic cells in various states of mitosis, with an occasional myelocyte. A hematologist considered the blood picture to be that of an acute monocytic leukemia of the monoblastic type. The patient stated that for the last 9 months he had not felt well. He had noticed increasing fatigue and weakness and had had occasional night sweats. Despite vigorous supportive treatment and some teleroentgentherapy, he developed acute pulmonary edema and hemorrhagic manifestations, and expired on 16 June. Necropsy was not done.

COMMENT

Diagnosis.—The diagnosis of leukemia is simple in the classic cases. This statement applies to both the acute and chronic forms. However, as the preceding case reports testify, there are many patients whose initial symptoms are vague, whose physical findings are meager, and whose blood picture so closely approximates the normal that only a competent hematologist can make the diagnosis with certainty. Such patients may require prolonged observation, the obtaining of material for biopsy, and chemical and bacteriologic study to exclude other diseases.

Difficulty in diagnosis may arise (as in case 3) because of the

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3. (Case 6.) The blood smear shows a predominance of monocytes. A majority are immature, probably monoblasts. The cytoplasm is moderate in amount and grayish-blue with fine granulation. Some of the nuclei are divided and folded over. Nucleoli are readily seen in considerable number. Occasional monocytes contain cytoplasmic vacuoles. X 1,500.

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history of an initial infectious disease and sulfonamide therapy. The sulfonamides and other depressants of hematopoietic function are now so widely used that the possibility of their previous use must be considered in any patient with a granulocytopenia. Leukemoid reactions may also lead to diagnostic error; they are not commonly encountered in the Navy age groups, however, and may be excluded by the study of repeated blood smears. Infectious mononucleosis no longer causes diagnostic difficulty, the familiar positive heterophil antibody reaction and the mature appearance of the lymphocytes serving to establish the existence of this disease. The exclusion of Hodgkin's disease or lymphoblastoma ordinarily requires a lymph node biopsy or observation of the patient after the therapeutic test of irradiation.

Final and accurate diagnosis of the leukemic state, in the last analysis, must always depend on a study of the morphology of the leukocytes. The less experienced observer may recognize that abnormal cell forms exist in the smear without necessarily being able to make a proper classification. In such cases, unstained slides may be submitted to those who are more familiar with the histologic appearance of immature leukocytes. Peroxidase stains and even supravital technic may be required.

With any method, careful staining technic is essential. In many instances the Wright's stain has not been properly prepared. At this institution it was discovered that the Wright's stain in use was of such a character as to preclude the study of finer cytologic detail. Wright's stain in tablet form may be variable in its staining quality. According to the Navy formula now in use, the staining is frequently too intense. The use of powdered Wright's stain was therefore resorted to, triturating 0.1 gm. in 60 cc. of methyl alcohol as compared to 0.3-gm. tablets per 100 cc. as originally recommended.

Improperly prepared Wright's stain also leads to confusion in those cases in which sulfonamide therapy has been employed, and nuclear changes are occasionally noted, not only in the granulocytes as described by Kracke (*2*), but also in the lymphocytes. With lymphocytes especially, chromatin material within the nuclei may become distorted in the staining process, giving rise to a bizarre appearance of the cells. Inexpert hematologic study under such circumstances may quite readily lead to error.

Treatment.—Neither the acute nor chronic forms of leukemia are amenable to any known form of treatment, and no person with an authentic case is known to have recovered. In the chronic forms of the disease (*3*) irradiation may give temporary relief of symptoms and prolong life. In the acute forms of the disease (*4*), which

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compose the majority of cases seen in Naval service, roentgen-ray therapy is of limited usefulness. It may be employed under skilled direction and has often been of value in controlling local leukemic infiltrations; it does not, however, appear to alter the inevitably fatal course of the disease.

Teleroentgentherapy (*5*), the "x-ray bath," appears to be tolerated fairly well by some patients with acute leukemia, but must be used with great caution, if at all, on those with low leukocyte counts. In reviewing the present series of cases, it is apparent that only a very few patients derived even transient benefit from any type of x-ray therapy, and there were some instances of actual harm from its use.

We have had no personal experience with radioactive substances (*6*) (*7*), but have been unable to learn of any case in which they produced more temporary relief than might have been obtained from roentgen-ray therapy. It is believed that their use is contraindicated in acute leukemia.

Penicillin therapy has been of benefit in controlling the fusospirochetal infections so often seen in the oral cavities and in keeping in check local infections with pyogenic cocci. Its use does not in any way influence the course of the disease but it may add greatly to the patient's comfort.

Many drugs have been used in the treatment of chronic leukemias (*7*), including arsenic and benzol. Some mildly encouraging results have been reported, but in general little can be expected from their use.

In general it appears that no treatment is of the slightest avail in the acute forms of the disease. The natural desire to "do something" often stimulates to patently useless therapeutic efforts. The means of palliation previously discussed (penicillin therapy, transfusion of blood, and sometimes irradiation) seem to be all in the way of treatment which can be considered justifiable.

SUMMARY AND CONCLUSIONS

An unusually large group of patients with leukemia has been observed in a Naval hospital, about 50 percent of the cases presenting some peculiar features which led to difficulty in diagnosis. It is believed that a diagnosis of the leukemic state would be made more often if greater attention were paid to the possibility of the disease in patients with obscure febrile ailments, granulocytopenias, and lymphadenopathies. The necessity for prolonged observation, biopsies of lymph nodes and bone marrow, and expert hematologic study is emphasized by the cases reported in detail.

No type of treatment offers any hope; transfusions, and the use

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of penicillin to control bacterial infection in the mouth, serve chiefly to make the patient more comfortable and alleviate suffering. Roentgen-ray therapy is not without hazard in the acute or subleukemic case and rarely prolongs life.[2]

ACKNOWLEDGMENT.—We are greatly indebted to Dr. Harry Wyckoff, of the Stanford University School of Medicine, for his help in hematologic studies.

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[2] Since this paper was prepared for publication the following cases have been admitted to this hospital, and their diagnoses established as follows: Chronic lymphocytic 4; chronic myelogenous 1; acute myelogenous 1; and acute monocytic one.

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MORPHINE AND RESPIRATION

Contrary to popular opinion morphine does not increase the depth of respiration, according to Dripps and Comroe of the University of Pennsylvania, who administered the drug to 49 normal persons ranging in age from 19 to 88 years, and from 42 to 99 kilograms in weight.

Following intravenous injection, morphine produced maximal depressant effects within 3 to 7 minutes in the majority of instances. Respiratory minute volume, rate and tidal exchange were diminished. The intensity of action of morphine on respiration is not significantly increased by intravenous administration.

The maximal respiratory depression following morphine is approximately the same whether the morphine is administered intravenously or intramuscularly.—DRIPPS, R. D., and COMROE, J. H.: Clinical studies on morphine. Anesthesiology 6: 462-468, September 1945.

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EARLY RECOGNITION AND TREATMENT OF VASCULAR INJURIES

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In the treatment of war wounds, it is necessary to be alert to the possibility of vascular injury. Vascular injuries are easily overlooked on superficial examination. In the case of any wound in the area of major vessels, careful examination by a medical officer for the presence of an arteriovenous or false aneurysm (pulsatile hematoma) is essential. These injuries, if undetected, may not only endanger the viability of the extremity but may cause extensive impairment of muscles and nerves; or they may result in immediate, recurrent, or continued hemorrhage, threatening the life of the patient.

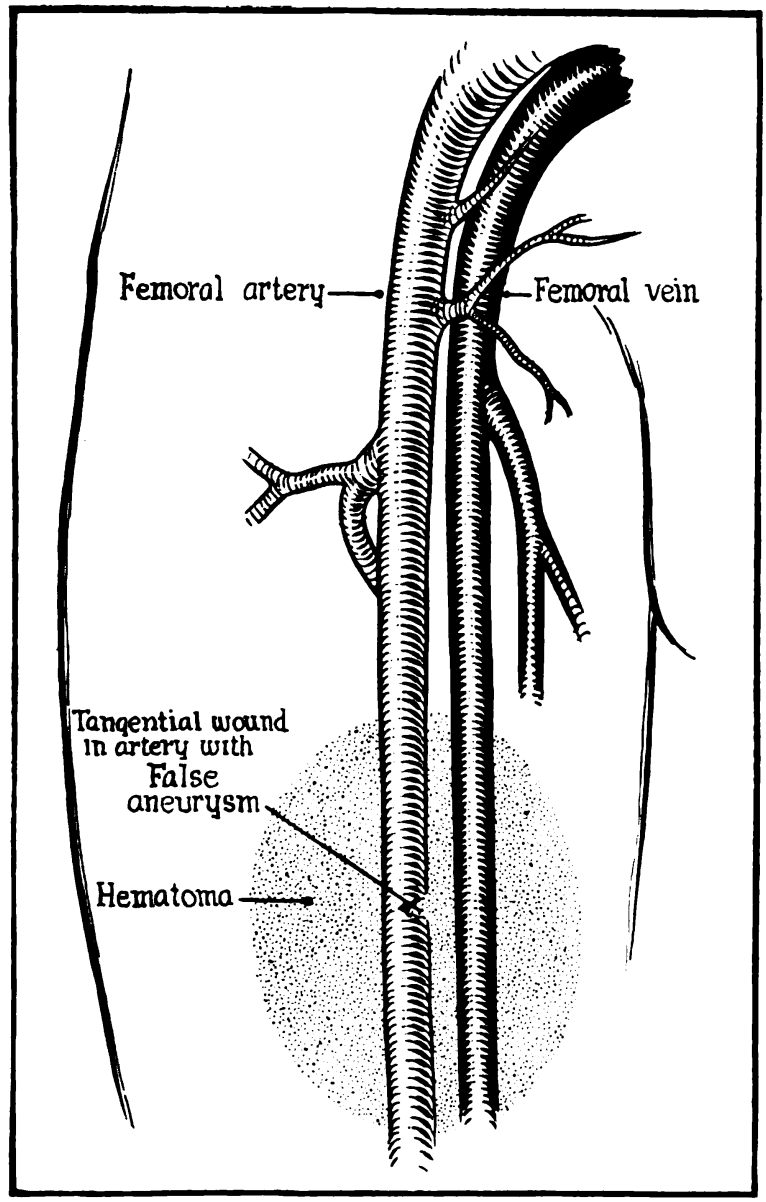
During a certain period, 49 patients with 49 vascular injuries were observed and treated in the surgical service of a mid-Pacific Naval hospital. Approximately 65 percent of the vascular injuries were due to shell fragments, the remaining 35 percent to bullets.

CHARACTERISTICS

False aneurysms.—In the false aneurysm (fig. 1), because of extensive pressure and infiltration of muscles, there is occasionally loss of function of the extremity, or the pressure of the hematoma may interfere with the collateral circulation. This may be of such a degree as to lead to ischemia and gangrene of the limb if unrelieved. To insure detection of these injuries, it is advisable to assume that every wound in the region of major vessels is potentially a vascular injury. There may or may not be any external evidence, but the presence of clots bulging from the wounds, infiltration of the surrounding tissues with hematoma, visible and palpable pulsations or thrill—all represent positive evidence. None of these signs may be present, however; therefore it is necessary to listen carefully with a stethoscope for a bruit.

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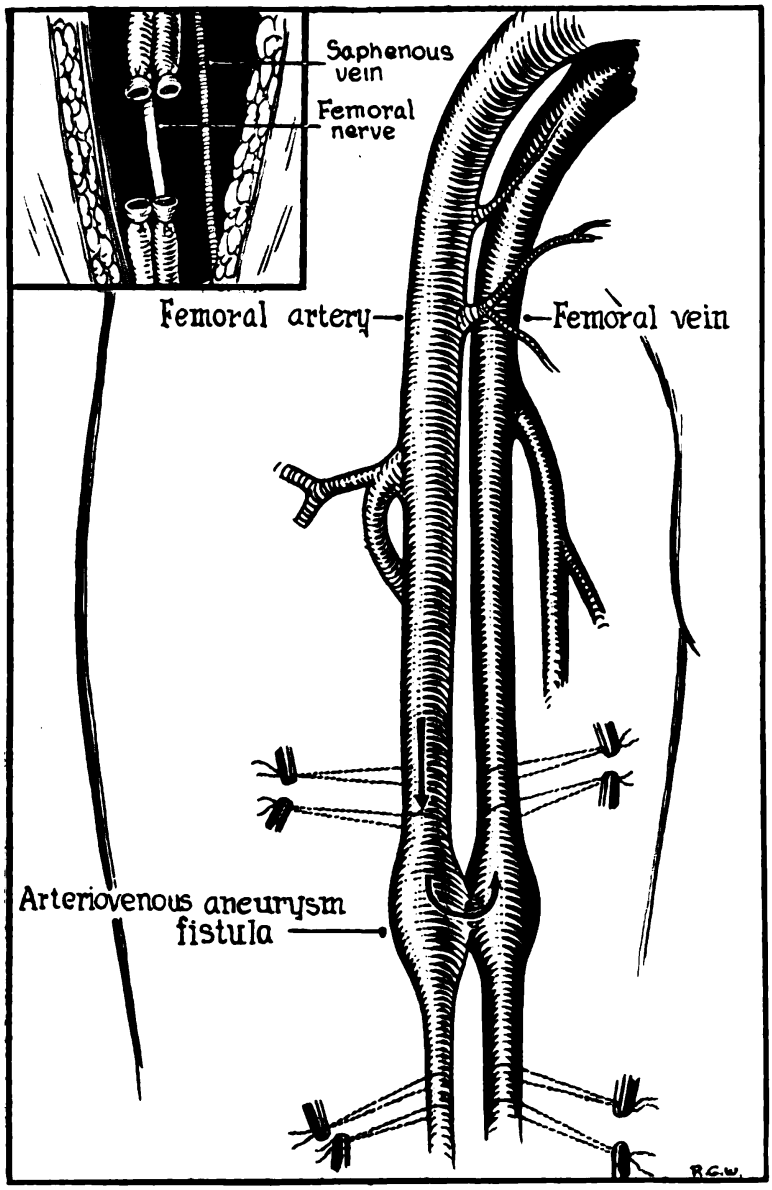
Differentiation between true and false aneurysms.—The clinical findings are not always reliable in differentiating between false and true aneurysms, because of the variability of the development of the aneurysmal process:



1. False aneurysm of femoral artery. Note that the wound is tangential in type and that a hematoma has formed at the site of the wound.

1. Generally, a true arteriovenous aneurysm (fig. 2) develops a thrill and bruit continuous throughout the cardiac cycle; whereas the false aneurysm, or pulsatile hematoma, develops a thrill and bruit which are mainly systolic in character. In those patients

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2. Arteriovenous aneurysm. Insert: Aneurysm excised. Note quadruple ligation of vessels involved.

with hematomas, the bruit is often not heard, because of the failure of the bruit to be transmitted through the thick wall.

2. The false aneurysms produce no significant changes in blood pressure or subsequent cardiac impairment, as their effect is primarily that of local tissue injury, whereas the true arteriovenous aneurysm will produce significant blood pressure changes and subsequent cardiac failure if it goes unrecognized and is not properly treated.

The amount and rapidity of cardiac failure will vary with the vessels involved and the shunt produced; in other words, the larger

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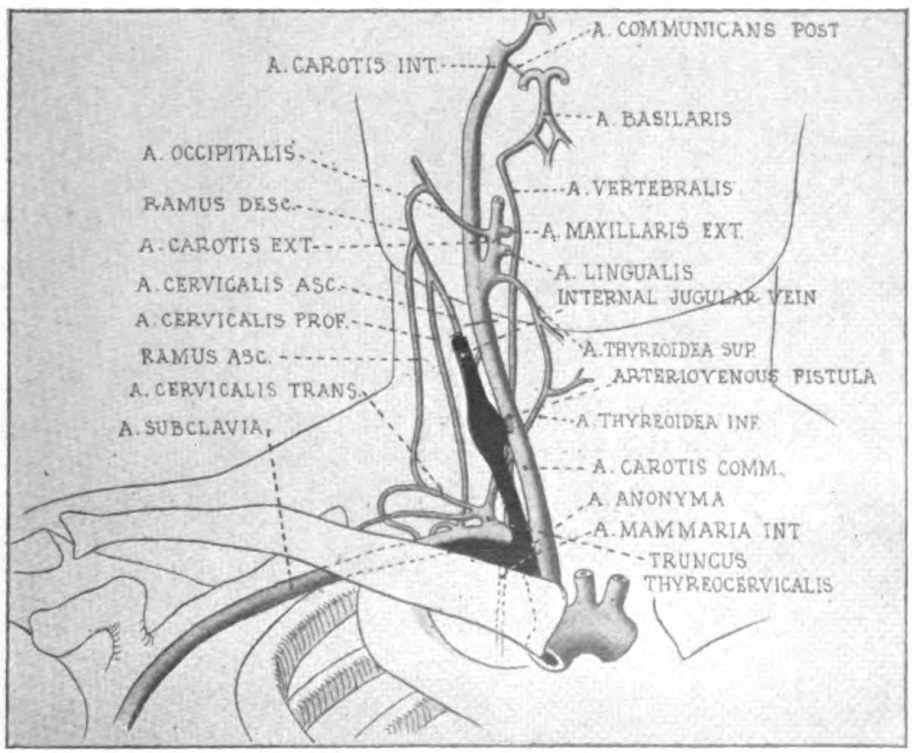
the vessels involved and the more proximal the lesion is to the heart, the greater will be the shunt and the more extensive and rapid the cardiac impairment.

A tangential wound of the artery is the type most commonly seen at operation in cases of false aneurysm, although occasionally the artery is completely severed.

INJURIES OF THE INNOMINATE, CAROTID-JUGULAR, SUBCLAVIAN, AND AXILLARY VESSELS

Distribution.—In a group of 14 patients there were innominate, carotid-jugular, subclavian, and axillary injuries. In the entire group, 10 had false aneurysms and 4 had arteriovenous. The distribution of the vessels involved was as follows: Two carotid-jugular (fig. 3), six subclavian, and six axillary. The two carotid-jugular cases were both arteriovenous aneurysms. Five of the subclavian cases were false aneurysms and one was an arteriovenous aneurysm. Of the six axillary aneurysms, five were false and one arteriovenous. One injury involving the innominate vessel is a false aneurysm and the patient awaits operation at this writing. To date, of the 14 patients, 13 have been operated on successfully.

Associated nerve injury.—There was associated nerve root in-



3. Arteriovenous aneurysm involving the carotid and jugular vessels.

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jury in all the false aneurysms involving the subclavian vessels but this cleared completely approximately 2 weeks after operation.

Surgical risk.—The risk of surgery is so great in vascular injuries which are too proximal to permit the use of a tourniquet (in our series those involving the axillary, subclavian, and innominate vessels) that in those cases in which the danger of hemorrhage is not present, a period of close observation is justified to determine the absolute need for surgery.

Occasionally there is a functional bruit heard in the subclavian triangle. This is a faint systolic rough sound of transitory nature, varying from examination to examination, and varying with the position of the patient. In this event surgical intervention is not indicated.

In addition, induration around and pressure on the artery may give not only a transmitted pulsation but a loud systolic bruit which will gradually disappear after a few weeks' rest under observation. Two such cases in our series, one in the subclavian and one in the innominate region, have cleared in this manner.

The true and false aneurysms must be distinguished and operation performed accordingly. It is especially true in cases of aneurysm when a tourniquet cannot be applied, that the operation must be planned and executed with extreme care and not undertaken except under ideal operating conditions; otherwise death is likely to occur on the operating table. Such operations can be performed safely only by the most experienced surgeons, working with experienced anesthetists and adequate assistance in a fully equipped operating room:

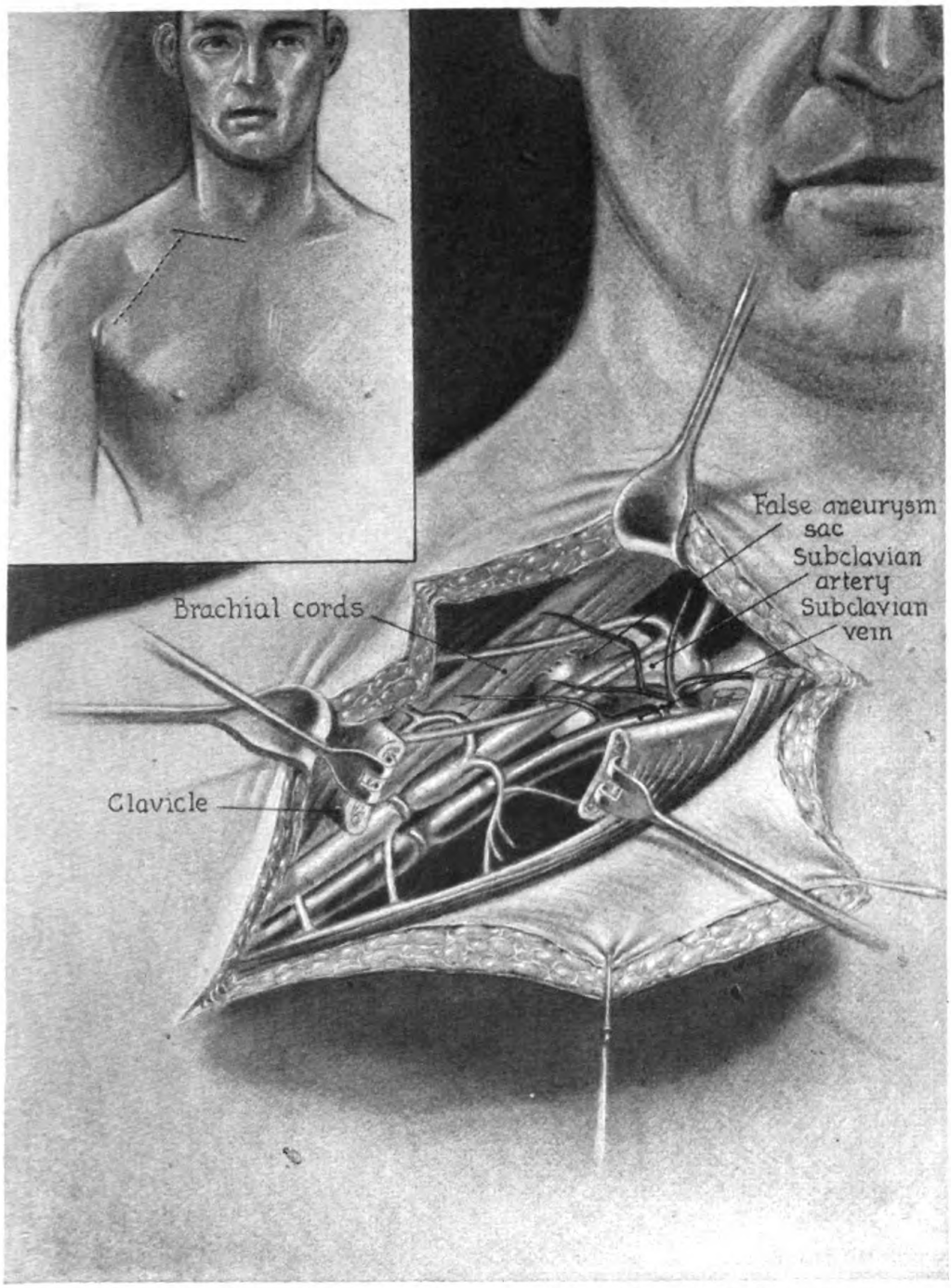
Procedure.—1. A wide exposure is necessary to control the vessels proximally and distally before the dissection is carried into the involved area. In order to get this exposure, it was necessary to cut the clavicle in three cases and to split the manubrium in one.

2. The vessels, both artery and vein, should be carefully traced distally and proximally so as to preserve all branches for collateral circulation until the aneurysm has been entered and the laceration in the artery has been exposed (fig. 4).

3. To determine whether quadruple ligation may be done safely, it is advisable to obliterate the proximal arterial segment in the aneurysmal process in order to observe whether there is pulsation in the distal segment. This is important because if adequate pulsation is noted in the distal segment, it signifies that adequate collateral circulation will follow ligation of the vessel.

4. Quadruple ligation is then accomplished above and below the opening, and the involved segment is excised (fig. 5).

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4. Surgical approach to aneurysm involving the subclavian vessels.

INJURIES OF THE BRACHIAL, RADIAL, AND ULNAR ARTERIES

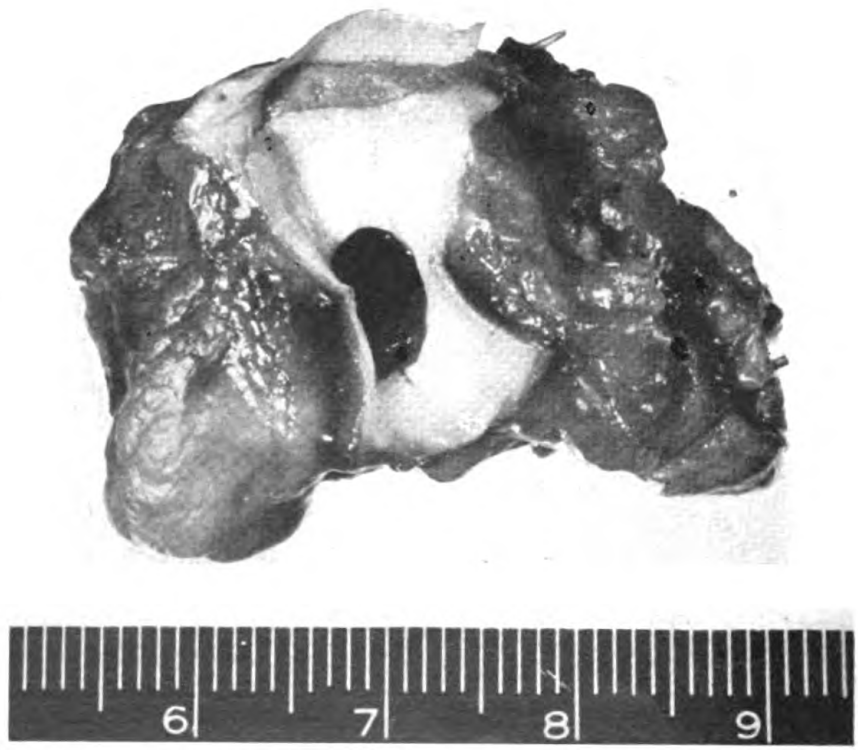
There were 14 cases, 2 arteriovenous aneurysms and 12 false, in the group of injuries of the brachial, radial, and ulnar arteries (fig. 6). Quadruple ligation was accomplished in the cases of arteriovenous aneurysm, and ligation of the proximal and distal segments of the artery in the false aneurysms. When the artery

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was not completely severed by trauma, it was severed surgically after ligation.

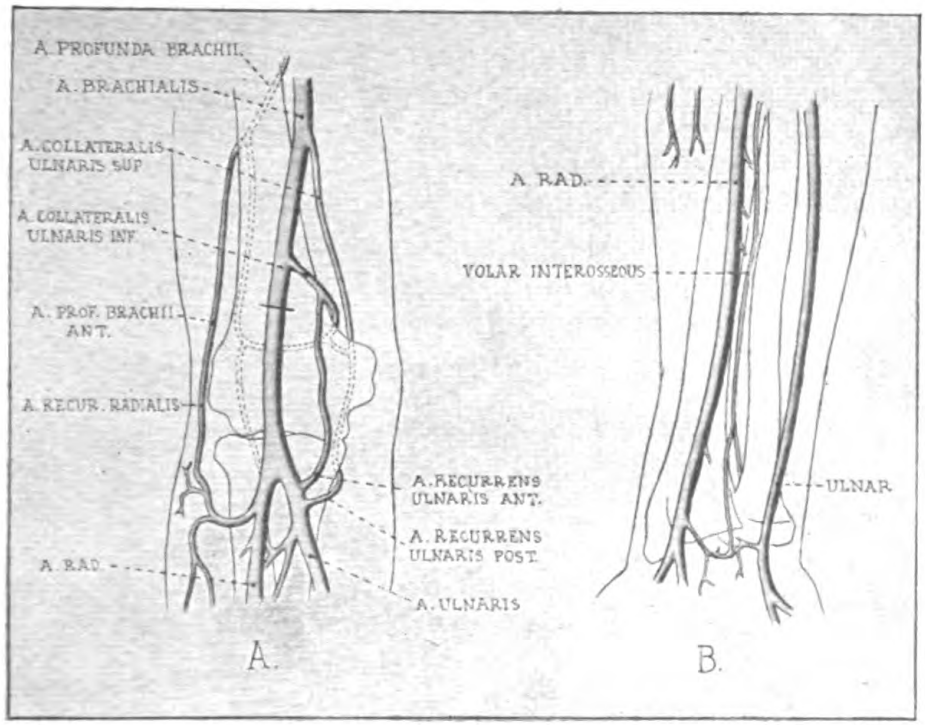
It is emphasized that in both arteriovenous and false aneurysms, quadruple ligation with excision was done in injuries of the major vessels (subclavian, axillary, femoral, and popliteal); whereas only ligation and division of the artery were necessary in the cases involving smaller arteries (brachial, radial, ulnar, and tibial). Quadruple ligation and excision are necessary in cases of false aneurysms of major vessels because ligation of the artery alone creates an extensive disproportion between the arterial and the venous flow in the extremity. This disproportion contributes to ischemia, local anoxia, and gangrene. By complete division of the artery, vein, and sheath, all major local sympathetic effects are eliminated and clinically there is less vascular spasm in the involved limb.

There were 6 cases of associated nerve injuries, one of which cleared soon after the hematoma was evacuated. The remainder will probably require nerve exploration. All 14 patients have been operated on with good results.



5. False aneurysm of subclavian artery illustrating the size of the opening in the artery and the surrounding organized hematoma.

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6. (A) Brachial artery; (B) ulnar and radial artery, and their anastomoses.

ANEURYSMS OF THE FEMORAL, POPLITEAL, TIBIAL, AND GLUTEAL VESSELS

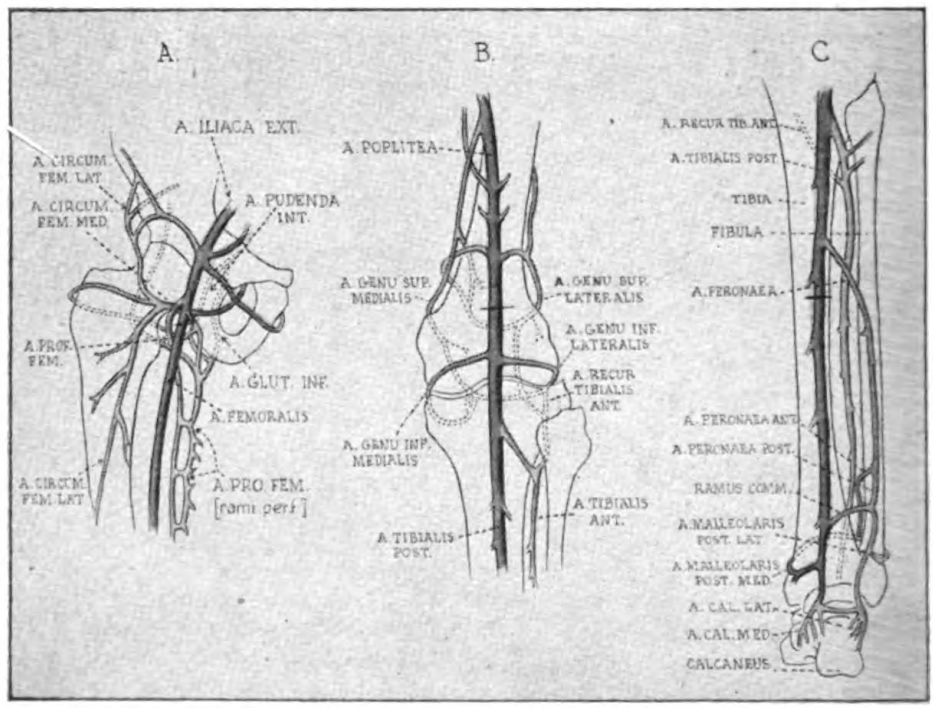
In a group of aneurysms involving the vessels of the lower extremities (fig. 7), there were 21 vascular lesions, 13 involving the femoral artery; 5 of these were arteriovenous and 8 were false aneurysms.

Before an aneurysm proper was excised, the main vascular trunk above and below the aneurysm was isolated and held by soft rubber catheters to control hemorrhage during the isolation of the aneurysm. The artery and vein above and below the aneurysm were ligated and divided, and the aneurysmal process was excised. In one instance it was necessary to isolate the iliac artery and vein extraperitoneally in order to have control of the vascular trunk above the aneurysm which was 1 inch below the inguinal ligament. Because of the extensive hematoma, control of the iliacs was advisable; otherwise it would have been impossible to isolate the proximal femoral vessels.

In two instances a paravertebral block was performed approximately 1 hour after operation because of inadequate collateral circulation. Increased warmth and adequate circulation of the extremity were noted following this procedure.

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One patient had a large hematoma of the buttocks associated with a false aneurysm of the gluteal artery. In such a case, instead of exposing the aneurysm through the hematoma, it is better to approach the process laterally, by severing the gluteal attachments at this point and reflecting the muscle. Such an exposure offers a more direct approach to the gluteal vessels. This also enables the surgeon to control hemorrhage more rapidly and efficiently as well as to isolate the artery under direct vision.



7. (A) Femoral; (B) lower femoral and popliteal; (C) tibial arteries and collateral circulation.

There were two aneurysms of the popliteal vessels; one was arteriovenous and one false. Those aneurysms involving the tibial arteries numbered five, and all were false aneurysms requiring evacuation of the hematoma and ligation of the proximal and distal segments of the artery as well as severance between ligatures when these were not already cut by the injury.

Postoperatively, in all operations of aneurysms involving vessels of an extremity, a light plaster mold for immobilization was applied for approximately 2 weeks to give rest and comfort.

GENERAL PLAN OF TREATMENT

1. Anemia was first corrected by repeated transfusions.
2. Operation was performed early; that is, approximately 4

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weeks after the initial injury and not 2 or 3 months later when further collateral circulation would have developed.

3. General anesthesia was used in all instances.

4. Before the operation was begun, a cannula was inserted in one of the veins of the ankle and a large needle in the cubital vein for the administration of blood; thus a continuous and adequate blood volume was assured throughout the operation. This was an important measure of safety in these operations. Shock was never a problem in our cases, although on occasion, when the aneurysmal process was entered, there was sudden loss of blood.

5. Before the aneurysm proper was treated, the main vascular trunk above and below the aneurysm was isolated and held by soft rubber catheters to control hemorrhage during isolation of the aneurysm. The artery and vein above and below the aneurysm were ligated and divided, and the aneurysmal process was excised. By ligation of a major artery alone, a great disproportion is created between the arterial and venous flow in the extremity. This leads to ischemia, local anoxia, and gangrene. Quadruple ligation is applicable to both true and false aneurysms involving major vessels, but in false aneurysms of the smaller and more peripheral arteries, ligation of the artery is sufficient. In patients in whom complete mobilization and excision of the fistula were impossible because of involvement of important structures, ligation of the artery and vein proximally and distally to the fistula was accomplished.

6. Penicillin used preoperatively and postoperatively in infected wounds has permitted earlier operation with more safety than was formerly possible.

SUMMARY AND CONCLUSIONS

1. The possibility of false aneurysm (pulsatile or tamponade hematoma) or true arteriovenous fistula should be considered in every wound of the neck, thorax, or extremities.

2. The area of all such wounds should be examined by palpation and auscultation. A bruit is the most consistent early sign.

3. Early operation, that is, from 2 to 4 weeks after injury, is preferable, provided the patient can be evacuated to a center where adequate facilities and trained personnel are available.

4. Early operation offers the following advantages: (a) Further hemorrhage is prevented; (b) pressure of a large hematoma, which otherwise might interfere with the collateral circulation or impair nerve and muscle function, is released; (c) the possibility of infection is reduced, because the hematoma and devitalized tissue serve as culture media when allowed to remain

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longer; (d) the period of convalescence is shortened; (e) prolonged worry by the patient is overcome concerning the potential hazard associated with the lesion and the unavoidable operation; and (f) cardiac impairment resulting from an arteriovenous aneurysm is prevented or minimized.

5. The results obtained in this series of patients have been possible because of (a) the adequate collateral circulation in this age group; (b) the continuous administration of an adequate amount of blood during the operative procedure; (c) the early operation; and (d) adequate exposure. It is repeated for emphasis that adequate surgical exposure is essential before approaching the aneurysmal process. The larger vessels above and below the aneurysmal process should be isolated in normal tissue. The surgery should proceed from the outside toward and into the process rather than by direct entrance.

6. There were 49 patients with 49 vascular lesions. At this writing 48 of the patients have been operated on without a death and there was no gangrene subsequent to surgical intervention.

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GLOBIN INSULIN: A CLINICAL STUDY

Analysis confirms the favorable reports on the value of globin insulin in moderately severe diabetics requiring a large dose of protamine zinc insulin alone for stabilization. However in the more severe cases needing separate injections of protamine and regular insulin, results with globin insulin were not so favorable. Only 2 of 6 such patients were controlled satisfactorily with a single dose of globin insulin. Close scrutiny of the literature on globin insulin reveals that there are few detailed clinical reports on any large series of cases which previously needed both protamine and regular insulin. In those papers, which do discuss this type of diabetic, the degree of regulation is judged by absence of glycosuria rather than by blood sugar tests. Since in treatment with protamine zinc insulin it is often considered not advisable to eliminate glycosuria because of the danger of nocturnal hypoglycemia, and further because of well-known wide individual variations in renal threshold for glycosuria, it is clear that there are many pitfalls in evaluating diabetic control by urinary sugars alone.—TRASOFF, A.; BORDEN, C.; and MINTZ, S. S.: Globin insulin; clinical study. Am. J. Digest. Dis. 12: 313-315, September 1945.

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SYMPOSIUM ON MILITARY MEDICINE ABOARD THE U.S.S. *SAMARITAN*

A. EARLY TREATMENT OF ORTHOPEDIC CASUALTIES ON A HOSPITAL SHIP

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Lieutenant (MC) U.S.N.R.

This is a résumé, from an orthopedic standpoint, of a little more than 1 year's work aboard a Naval hospital ship in the Pacific theater of war. During this time most of the patient load came from the combat zones where the ship ran in close to the islands. Patients were taken from four landing operations, the Marianas, Palau, Iwo Jima, and Okinawa.

For 4 months we were at a forward anchorage for the fleet, receiving casualties from enemy action by ship and plane. In this discussion only the combat casualties, of which there were 7,846, including 1,100 men evacuated by sea and air to base or fleet hospitals after initial treatment aboard this ship, will be considered. The great majority of the patients were brought aboard within 48 hours after being injured in battle; many were seen within 12 hours, and only relatively few more than 4 days following injury.

The term "orthopedic patient" as used here includes injured personnel with trauma to the bones, joints, tendons, muscles, nerves, large vessels, or with massive soft tissue wounds of the extremities requiring operation, immobilization, or a combination of both. Most large metallic foreign bodies, from whatever source, produced compound fractures, joint injury or massive soft tissue wounds. Practically all of these lesions required operation and immobilization by plaster cast or splint. The small foreign body, which was removed easily with or without anesthesia and did not require splinting or casting, has not been included in this discussion.

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A few of the patients seen here had orthopedic wounds complicated by burns. When the orthopedic problem was more important and treatment of the burn a secondary matter, the casualty was classed as an orthopedic patient. However if the patient was so seriously ill from the burn that any orthopedic condition present could not be treated, he was not placed in this orthopedic category. The same grouping applies to the orthopedic condition occurring along with visceral, chest, skull, and urologic injury. The orthopedic lesion was always treated by immobilization, but when the other wound precluded any further orthopedic therapy, death almost always was the outcome. In those instances the orthopedic condition was not included in this series. These cases were rare.

Eighty-five percent of all patients requiring surgery were orthopedic patients. The following table is a record of the operative work done. About 1,000 pounds of plaster of paris were used on each beachhead trip, with double that amount for one of the highest casualty loads when there was an 11-day run to the unloading port. Because of the rush of work, the casts could not be permitted to dry thoroughly, so they were made somewhat heavier than is desirable.

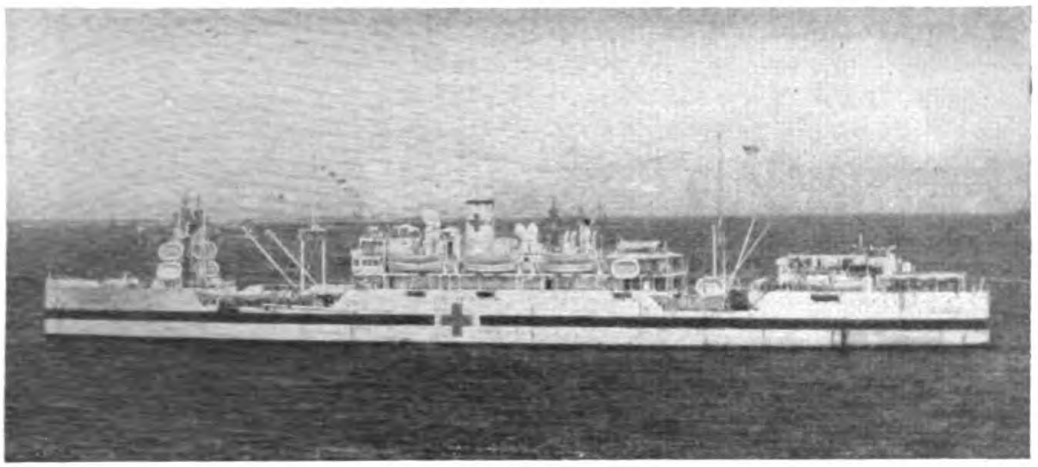
ORTHOPEDIC OPERATIVE WORK*

Orthopedic patients brought to surgery	1,585
Repeat orthopedic operations	117
Orthopedic operative cases (although many patients had several operations or casts they are tabulated here as one)	1,702
Shoulder spicas	193
Forearm casts	191
Banjo casts	152
Total plaster casts for upper extremity	698
Hip spicas	201
Casts to midthigh or groin	252
Boot casts below the knee (a few banjo casts included)	196
Total casts for lower extremity	649
Back casts and Calot jackets	31
Extremities, other than above, operated upon and put in plywood, basswood, plastic or wire splints (often for wet dressings) or just dressed	735
Total plaster casts and spicas	1,378
Total extremities operated upon	2,113

* The injuries to the joint regions and to leg and forearm generally produced compound fractures involving multiple bones, but in the above tabulation all lesions to an extremity are listed as one.

The patients received treatment both in the ward and operating rooms that would compare favorably with that obtained in fleet and base hospitals. There were some limitations of individual nursing attention, but all the essential measures to combat shock,

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U.S.S. *Samaritan.*

anemia, infection, dehydration, lack of salt, vitamins, and minerals, and loss of weight were adequately and promptly put into operation. The treatment of shock for these combat casualties has been discussed thoroughly by others, and we have nothing new to offer. The methods usually employed were begun by the shock team the moment the patient was brought over the side, and a constant endeavor was made to protect him from further shock throughout the trip to the unloading port.

At times patients were brought aboard chilled and seasick, which added materially to the problem of combating shock. Whenever possible, the patients were given roentgenographic examination on the way to the wards or on the way to the operating rooms. All moving of the injured was kept at the absolute minimum. Administration of plasma, serum albumin, blood, and other intravenous fluids was instituted in the wards and often continued during the operation and afterward as long as necessary. Multiple routes were at times employed, frequently femoral vein puncture, occasionally penile and sternal routes.

Our experience corroborates the universally accepted belief in the efficacy of whole blood in the treatment of shock accompanied by hemorrhage. With a patient in good general condition and an acceptable hematologic picture, there does not seem to be any need to continue the transfusions. Reactions (all but one of which were minimal) from the blood transfusions were under 5 percent. About 1,000 pints of blood were used, most of it from the regular blood bank (group O) of the Navy and from 1 to 3 weeks old. Some as old as 4 weeks was used but none older, and none of this bank-blood was cross matched. The one hemolytic reaction was in a moribund patient, and this blood did not come from the blood bank. The need for transfusions was regulated by the determina-

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tion of hemoglobin concentration, hematocrit readings and erythrocyte counts.

As regards plasma and serum albumin, our views are those of most who have treated large numbers of combat casualties seen early after injury. A word, however, concerning serum albumin. To combat its withdrawing effect on the interstitial fluid of the body, 1,000 cc. of normal saline solution, or 5-percent dextrose in normal saline was routinely administered along with each unit of the albumin.

In cases of skeletal or soft tissue injuries, an early, careful examination was made for nerve as well as blood vessel trauma. The exact status of these structures often could not be ascertained until operation, but a thorough search was undertaken in each extremity to find out how adequate the blood supply and peripheral nerves (both sensory and motor) were. These observations, along with any changes, were noted on the clinical chart.

Nikethamide in doses of from 3 to 5 cc., when given intravenously, and repeated every 3 or 4 hours when necessary, seemed at times to be of distinct benefit in combating shock. However we have no conclusive proof of this, as it was used along with other agents and measures.

In so far as was possible, an attempt was made to ascertain what and how much medication each patient had had before coming aboard. Many times no records were available, or the ones at hand were torn or smudged. For the most part, however, patients had had penicillin or sulfonamide therapy and, of course, morphine.

Our use of penicillin and sulfadiazine did not differ from that employed almost universally throughout the armed services. Of the two drugs, penicillin seemed the more efficacious in preventing and combating infection, but its mode of administration was a distinct disadvantage. The calcium salt produced very little pain at the injection site, but the sodium one was quite objectionable in this respect. For seriously ill patients, especially when gas gangrene was feared, the two drugs often were combined with what seemed to be a better effect than with either one alone. At operation as much as 100,000 units of penicillin were given intravenously at one time with no discernible ill effects.

The patients with badly infected wounds, or those who were very seriously ill, in many instances were in no condition to undergo immediate amputation or other surgery which was clearly indicated. Routinely these foul-smelling, necrotic, badly infected limbs were packed in ice. If amputation was to be done later, a tourniquet was applied just proximal to the infected area after

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an hour's chilling. All that has been written on the subject about subsidence of temperature, rapid improvement in well-being and alleviation of pain by this refrigeration was dramatically brought out. Operation was then done on an elective basis.

The technic of wide open incisions with muscle and fascial splitting and removal of all necrotic muscle or other tissues followed the generally accepted procedures. Postoperative wet dressings or irrigations with azochloramid, 1:3,300 in normal saline solution, or 500- or 1,000-units-per-cc. solutions of penicillin were employed when indicated. Small catheters or Dakin's tubes were usually placed in the depths of the wounds in order to get the solution near the source of the infection.

Although 53 cultures for gas gangrene were made, only two clear-cut cases with Clostridium perfringens were found. Practically all of the cases that showed gas in tissues clinically and by x-ray examination, on culture revealed gas-forming bacilli (usually unidentified gram-negative rods). Clostridia were not obtained in cultures of these cases, most of which did not present the classic picture of gas gangrene infection.

One of these patients had the infection in the last remaining extremity (right upper) where a black, foul, gas-filled, almost formless wrist and hand added its toxic burden to the three already amputated and severely infected stumps. He came aboard in a critical state, in great pain, with an erythrocyte count of 1,800,000, and a hemoglobin concentration of 48 percent. At entry 10,000 units of gas gangrene antitoxin were administered and penicillin therapy was begun. He was prepared for amputation by the usual measures, and 2,000 cc. of blood was administered within 24 hours, refrigeration was applied, and a tourniquet was placed on the midforearm. He received an additional 1,000 cc. of blood on the day after the operation, and at that time the hemoglobin concentration was 70 percent, the erythrocyte count 3,900,000, and the leukocyte count thirty-one thousand.

In the following article of this symposium, guillotine amputations through the long bones are discussed. There were 131 such amputated extremities aboard. Seventy-one were amputated on this ship; the remainder had already been amputated. The total number of traction stirrup casts applied was one hundred fifty. This method for pulling the skin over the stump end is employed at the close of the amputation operation, permits easy redressing of the stump, and is effective in bringing the skin down.

The principles laid down by Orr and Trueta have been proved over and over again to be a sound basis for the treatment of orthopedic war casualties. On a ship such as this, there was no place

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for traction and suspension, or traction and countertraction on any appreciable group of patients. In a rough sea in crowded conditions and with inexperienced personnel, the maintenance of such a setup in anything approaching a well-functioning unit would be out of the question. A few patients with cervical and upper dorsal spine injuries were kept under head halter traction, but even in these few instances it was difficult to keep the apparatus functioning well at all times.

As has been said, nothing can take the place of plaster of paris. However this form of therapy must be handled from start to finish with meticulous care at every step. The patient must be in the optimum condition for operation. A thorough, careful debridement with adequate preparation of the surrounding skin is essential. Gentle reduction of the fracture, usually under direct vision or palpation through the soft tissue wound, must be performed and maintained until the well-padded and correctly applied plaster cast has been put on. Motion of all joints, except those that are immobilized in the cast, must be maintained from the start.

An edema-producing dependent position must be guarded against, and any other cause of swelling, any loss of motion or sensation of the distal digits, significant skin change, or alteration in pulse must be cared for at once by cast splitting, bivalving, or further surgery. The surgeon must be ready at a moment's notice to reoperate and remedy the lack of adequate drainage, or remove an overlooked foreign body (dirt, rock, coral, or other extraneous matter) or a loose piece of bone. Often, especially about the knee joint, one or more stab wounds must be made for counter drainage. Badly fractured or traumatized patellae were usually removed.

Much of the adverse criticism of the Orr and Trueta treatment seems, in our opinion, to be due to the slipshod "put in plaster and forget for 2 or 4 weeks" practice of treating these injuries, with no careful watch maintained or remedy made for every undesired sign or symptom or continued fever. However we are concerned solely with the treatment of casualties from the beachhead to their next stop.

The only place where skeletal fixation in plaster was used more or less routinely has been in the treatment of the fractured femur, which was almost always compounded. The usual pin employed was the ⅛-inch Steinmann pin, although the 3/16-inch one and a large type Kirschner wire were also used. The pins were usually driven through the upper or lower tibial shaft, trying at all times to have the pin sites in areas of intact, healthy skin, and at least 12 inches from the nearest edge of the compound fracture wound.

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Seldom was the supracondylar site of the femur used in fixation.

On one trip a dozen patients with fractured femurs were aboard for 3½ weeks; eight of these had their spicas changed for one reason or another. All the pins were through the lower tibia and only one had been giving a little pain on one side of the ankle where there was a slight seropurulent drainage. This pin was removed about 2 weeks after it was put in, another inserted through the upper tibia, and a new spica applied, incorporating the pin. In 4 days the lower pinhole was redressed and found to be well on the road to healing, with no signs of any serious sequela. Had this lower pin been left in for a few more weeks or months, a ring sequestrum, or a real osteomyelitis, would probably have resulted.

Very occasionally a Kirschner wire was used through the olecranon process of the ulna or the metacarpals, and incorporated in plaster, with the fingers and thumb left free for normal range of motion, which was insisted upon from the start. All the wires or pins were held firmly in the cast through the use of small ship-made brass or aluminum slotted collars with screws that held the pin tightly to the bottom of the slot. The wires were cut off close to the collar, all metal was covered with plaster, and no corks were ever used. Such a pin cannot bend, slip or rotate as long as it is held fast in the cast.

At the start it became obvious that the orthopedic staff had to be increased hastily in order to handle the work. The two general surgeons and urologist were generally kept busy with the skull, chest, abdominal, and genito-urinary work. Whenever they were caught up, of course, they helped with the orthopedic load. Luckily the chief of neuropsychiatry and the radiologist, who were also two of the loading officers, had been well grounded in general surgery. After a day or two of assisting in the orthopedic operating room, they were given an operating room of their own where they took care of many of the distal injuries of the extremities.

This room was the endoscopic one, part of and adjacent to the main x-ray establishment, on the same deck and close to the operating room suite. It had a cystoscopy table, a scrub basin, instrument sterilizer, x-ray viewing box, and two excellent overhead floodlights. The x-ray table was easily altered to serve as a flat operating room table. When a second general operating room was needed, this room was used for that purpose by adding a well-functioning suction apparatus, which was made aboard and attached to the water faucet.

With the second load aboard, which was considerably larger than the first, a third orthopedic operating room was needed ade-

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quately to handle the work. The anesthesia recovery room, which was 8 feet by 10 feet, well ventilated, adequately lighted and a part of the operating room suite, was used. A very satisfactory orthopedic table described in a previous article [1] was made by the shipfitters in less than a day's time. Several ships and a 600-bed shore hospital have reported satisfactory service from "home-made" tables copied from this one. Another medical officer was put in charge of this room where, with two or three hospital corpsmen, he did the same type of work the orthopedist did in his room. In these three rooms we easily handled from 40 to 50 "run of the mill" orthopedic patients every 24 hours.

Every morning a priority list was made, so that a general plan for use of the operating rooms could be laid out right through the day. Of course emergencies altered the operation sequence. All patients with persistent dangerous hemorrhage, or those needing immediate amputation, who were able to stand surgery, were placed on a Number 1 priority listing.

The patients with priority listing Number 2 were the ones who were in good general condition but needed plasma, blood, fluid, food, salt, and other general measures to be brought to the optimum condition for operation. These patients were able to wait a day or two before surgery.

The third listing of patients comprised the ones who had been operated upon or had been well taken care of on other ships, and whose treatment could be deferred until the last day or two of the trip as long as their temperature and clinical course did not become alarming. Generally all casts already on patients who came aboard were changed. In only a few instances this was not done. On long trips, several of the casts applied on the ship had to be changed because of profuse drainage, softening, or the need for further surgery. There were relatively few patients in whom there was even a small chance of an osteomyelitis ensuing.

The single hip spica as opposed to the double or one-and-a-half one, where the cast goes down the well leg to the knee, brings up several points in favor of each type. There is a little more motion at the fracture site with the single spica. A double hip spica is also less liable to break or buckle. However the advantages of a single hip spica outweigh its disadvantages as compared with the other, especially with the bunks situated and made as they are aboard this ship. When extended high enough on the chest and made adequately strong, there is found to be ample

[1] JEWETT, E. L.: Ship-made orthopedic table. U. S. Nav. M. Bull. 45: 362-364, August 1945.

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immobilization of the proximal fragment of the femur for all intents and purposes by the single spica. When there was much motion at the fracture site, the patients experienced pain and a feeling of the bone ends grating as they were turned or moved about. This only occurred, however, in a very small number of cases. Whenever this situation existed, a one-and-a-half cast was applied, not always with elimination of the complaints.

Other advantages of the single hip spica cast are that it permits easier transfer by Stokes stretcher, the patient learns to turn himself in his bunk, and the well leg can and must be moved regularly. A patient in the double hip spica cast is helpless in regard to turning, use of the bed pan, etc. Activity is a very vital factor in the preventing of postoperative thrombosis and emboli. Some of the bunks on this ship are so arranged that single hip spicas fit into them very well, whereas double spicas, even of 20 inches spread, do not. Also the single hip spica cast has just so much less perineal, groin, and buttock plaster of paris to become soiled. Lastly it takes less plaster and time in application and is lighter.

Compound fractures of the humerus, even those involving the elbow, did much better in shoulder spicas than in ordinary arm casts. The hanging cast is excellent for many of the closed fractures of the humerus, but is not adapted for the type of compound fracture that was seen here.

The continuity of the enveloping "tube" of periosteum, fascia, muscle, tendon, subcutaneous tissue, and skin is a most important feature of the success of the hanging cast treatment. When this soft tissue "tube" is disrupted by massive wounds, the hanging cast is uncomfortable, and leads to a large amount of "weeping" and even bleeding. In some patients with thoracic, abdominal, or other injuries, a shoulder spica cast could not be applied, but a full upper extremity cast with a well padded shoulder cap proved satisfactory. Generally a wide muslin bandage was incorporated in the cap and secured around the patient's chest to keep the upper part in snug coaptation with the shoulder and trunk.

With the above-mentioned exception, plaster-of-paris shoulder spica casts were routinely applied for practically all of the humeral and elbow compound fractures as well as the injuries to the scapula and clavicle. Some of these patients had had adequate surgical treatment before coming aboard, and the spicas were applied here while the conscious patient sat up. The majority, however, required an operation and were placed in a recumbent position on the orthopedic table under general anesthesia. Spicas were also used for brachial plexus or other soft tissue wounds around the shoulder girdle and axilla without bone or joint injury when

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the patient had lost the power to abduct the arm, or when there was danger of the resulting scar restricting future abduction of the shoulder.

Shoulder spicas were generally applied with the arm abducted at from 70 to 80 degrees, the elbow placed at about a right angle, and the forearm parallel with the deck when the patient was in an upright position. The wrist was generally put into slight cock-up. With the various nerve injuries which were frequently found, the fingers and thumb were splinted in extension in order to prevent resulting crippling contractures.

Fractures of the metacarpals and phalanges without great destruction of tissues or massive infection were treated with banjo or Böhler splints, with rubber-band traction applied to needle fixation through the tips of the fingers. An 18-gage Wassermann needle, which had previously been filed half through at two points about 1 inch apart, was inserted through the distal fat pad of the finger as close to the base of the terminal phalangeal tuft as possible. By breaking off the two ends of the needle at the filed points, a hollow, all metal, 18-gage tube resulted. Through this tube a stainless steel wire was passed which, when looped beyond the finger about 1½ inches or so, provided excellent traction and needed no other spreader. Through this wire loop, a rubber band was run to the stirrup.

Most of these splints were applied with the patient under local procaine anesthesia, although about 25 were done under brachial block anesthesia. With massive destruction of tissue and infection of the hands and fingers, no traction device was deemed necessary. After debridement, these wounds were either treated with wet dressings of penicillin or azochloramid, or simply immobilized in plaster splints or casts.

Patients with spinal cord injuries in whom the paralysis had been sudden, complete, and persistent were merely treated symptomatically and tidal drainage of the bladder was employed. All of these casualties, of which there were several, were brought aboard after complete paralysis had been present at least 24 hours and generally more than 48 hours. There were three patients in whom paralysis was not complete, and laminectomies were performed as soon as paralysis or sensory changes began to get worse. In two of these patients metallic foreign bodies were removed from within the canal, and on one a decompression was performed for a subdural hematoma in the dorsal third and fourth region. The dura was injured by the metallic foreign body in only one case. All three operative wounds healed by primary union, with definite progressive neurologic improvement in each case. Two

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of these operations were done using local and one using general anesthesia.

Fourteen orthopedic patients died, one while on the operating table. This patient had been in good condition and a torn axillary artery was being ligated. There was no bone injury, no great loss of blood, and the death seemed to be due to an embolus (fat or clot). Another death was that of a blast-concussion patient who came aboard unconscious and had a simple fracture of the right femur. The femur was immobilized by a posterior plywood splint, as he was at no time in any condition for even an application of a spica. Postmortem examination showed the typical petechial hemorrhages through the brain found in these conditions. There were only two other deaths of patients who had been to the operating room. The others were all admitted either in a coma, or moribund, or died within a few hours presumably from emboli or extreme shock. Most of these patients had multiple extremely severe wounds with partial or complete traumatic amputations of the extremities. Some were packed in ice and tourniquets were applied, but nothing that could be done was effective.

Mention must be made here of the fact that a number of patients came aboard this ship with war wounds which had been sutured shortly after they occurred and were seen here a few days later. Many of them were not drained. Practically every one was infected, and in many instances large collections of pus and necrotic tissue and extraneous material were removed from these wounds.

Many tightly packed wounds were seen and several with through-and-through vaseline gauze drains. On the beach or a nearby ship, this is justifiable when the pack is going to be removed in a short time with ligation of bleeding vessels. But with all that has been said and written, it was lamentable that some infected or potentially infected war wounds were still being sutured tightly at the front-line stations. This by no means was a general practice but occurred frequently enough to warrant comment.

Incidentally some torn tendons from crush injuries when boats came together were repaired here, but these injuries were seen in a matter of minutes or a few hours after being incurred. We want to put in a word against—violently against—the use of the Spanish windlass or any other type of ankle or wrist hitch traction combined with a Thomas splint. The occurrence of pressure necrosis on the dorsum of these ankles and around the wrist became so prevalent that every such form of traction was immediately discontinued as soon as each patient was admitted to his respective ward. One of the authors (E. L. J.) has for many years been very much against the use of ankle or wrist hitch on

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any fracture. Even an experienced physician will have difficulty applying a well enough padded and adjusted hitch with adequate traction to do any good over a matter of 12 to 40 hours without endangering the well-being of the underlying skin and other soft parts about the ankle and foot.

Several dozen of these cases have been seen where the damage from the hitch is going to be a much longer and more difficult problem to the patient than the compound fracture of the femur. If these patients could be given definitive treatment within a few hours after application of such a device, it would be much safer, but in many instances these contraptions were on for many days without any loosening of the hitch or examination of the ankle or toes.

Another point in favor of merely immobilizing these injuries with no attempt at traction is that most of these limbs have muscle wounds which eliminate any great pulling effect on the distal part of the extremity. These muscles, even if they are not directly involved, are often in a state of flaccidity as a result of shock. Several of these cases have been seen in which a noticeable overpull was present. If any traction is deemed necessary, the only safe emergency type is that using adhesive tape, moleskin, or skin adherent and stockinet with plenty of padding about the ankle, a wide enough spreader, and just enough traction to immobilize the limb. This type has been widely discussed by many writers.

It has always seemed against all the principles of orthopedic surgery to have protruding bone ends pulled back inside of the limb, dragging with them all the dirt, bits of clothing, and bacteria that may be present. It is much better to have a compound fracture treated simply by sprinkling sulfanilamide powder or crystals, and applying an adequate snug sterile dressing with immobilization of the entire limb. The best splint for this purpose is probably the plywood (gutter) Navy-issue lower extremity splint. For the upper extremity the new plastic right-angle adjustable splint is the most satisfactory.

Such a fracture should not be reduced until the patient is where the limb can be handled according to the modern concepts of Orr and Trueta, from the initial preparation of skin to the final plaster cast, or by any other good method that can be carried out safely.

It is strongly contended that a nonpadded cast should never be put on in any front-line area for either compound or simple fractures. In conclusion, it is believed that operation, together with the plaster-of-paris treatment of Orr and Trueta, is superior as a means of adequately handling the greatest number of acutely injured orthopedic patients in the shortest possible time.

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B. COVERING THE GUILLOTINED STUMP

EUGENE L. JEWETT
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This article is a follow-up on a system of skin traction for amputated stumps which was described in an earlier article (*1*). The system has been changed slightly but remains fundamentally the same and has proved to be effective. In a little over a year in the Pacific combat area, this hospital ship carried 7,846 combat casualties. Amputation statistics for the long bones of the extremities during this time are as follows:

Total amputated extremities on ship	131
Bilateral amputations	13
Triple amputations	2
Quadruple amputations	1
Total amputees	110
Total amputations done aboard ship	71
Total traction casts applied	150

As has been stressed by others (*2*) (*3*), the guillotine type of amputation is the only one recommended for general use in the combat theater. On a well-equipped hospital ship, or at a similarly well-equipped shore hospital, a few flap or delayed-suture amputations may be performed. Several of the amputations which had been done before the patient was brought aboard had been sutured more or less tightly, some being of the flap variety. Generally these were badly infected. There was only one such amputation (just above the ankle) in which an infective process was not found.

The types of skin traction described by Kessler (*4*) have all been encountered, and they performed their task well as a general rule. However all of these traction devices, whether used with Thomas splints or plaster cast-wire stirrup setups did not allow changing of the dressings without disrupting the apparatus. This led to the following observations:

1. The dressing often had been on for days without being changed, and infection was rampant and extensive, often rendering a higher amputation necessary.

2. The traction tapes or stockinets had come loose because they had not been made long enough. They should be at least 12 inches long (except on the inner side of a mid- or upper-thigh case, where

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this is not possible); many are made quite materially longer.

3. The cast, if used, should immobilize the proximal joint in extension, except in high arm amputations. This gives the patient more comfort while the severed ends of the muscles and tendons that traverse and move that joint are becoming adherent to the stump end.

Flexion contractures must be prevented, and the elimination of the patient's pain and anxiety on applying a hip spica to a recently amputated thigh is often dramatic. Every postoperative hour that adequate skin traction can be applied is of definite value in obtaining coverage of the stump with tissue.

No moleskin or skin adherent was available, so ordinary adhesive was used. The skin is painted with compound tincture of benzoin after being cleansed, shaved, and dried. One patient had a local allergy to the benzoin that did not, however, preclude the continuance of traction. In fact the skin under the adhesive was in much better condition than that outside. There were no cases of sensitivity to the adhesive.

The spreaders should be a little smaller in diameter than the stump in order to aid in pulling the skin edge down over the end. With too small a spreader, or none at all, in the first week or two, if infection is present, this pulling-over effect of the skin edge will tend to promote pocketing, and thus spread the infection proximally. There should always be ample exposed surface for adequate drainage, thorough inspection, and ease of dressing of the stump. The skin edge will cover the end adequately as the healing progresses, if adequate continuous traction is maintained.

The stump dressing is held in place by gauze ties attached to the traction tapes. Earlier, Montgomery or Kelley tapes were applied under or alongside the traction tapes, but the incorporation of the ties in the traction tapes resulted in a saving of time and material.

The dressing should be adequate but must not cover more than an inch or so of the distal skin edge, as all available skin should be put under traction. The plaster cast should be snug, especially over the stump end, which it should completely cover. The edge of the dressing is slightly proximal to the place of attachment of the ties. The cast should be brought down to the level of the attached ties, or about the same level as the stump end. The inner surfaces of the traction tapes, from the wooden endpieces back as far as the edge of the dressing, should be covered with crinoline or small pieces of tape in order to prevent sticking to the dressing or ties.

For traction, any one of many different devices may be used.

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At first no rubber was available so the windlass system was used and it worked well. The rubber situation was relieved by extra tubing left over after using the various intravenous fluid sets that had the rubber tubing enclosed. It was found, however, that stronger traction was needed than was at first employed. Four of the tubings, all tightly stretched, were used for each stirrup. Also each day, with both hands, the wooden spreader was pulled forcibly toward the distal loop of the stirrup. Often one-half inch or more extension of the skin was obtained by this method. As the skin came down, the cast tended to go up slightly, despite the minimal padding between the skin and cast and the snug application of the plaster. The groin was cushioned well with a felt pad (in the hip spicas) which helped. However this part of the cast had to be cut away, as it invariably rode up.

On the two trips of longer duration than 1 week from the battle fronts to the unloading ports, 10 amputation stirrup casts had to be changed. Usually in from 7 to 10 days the distal end of the cast has been pushed back, or the skin edge pulled down sufficiently so that 2 inches or so remain between the end of the stump and the edge of the cast. A new cast is then applied, with any loose traction tapes being replaced, and a new, smaller spreader used. Generally this procedure can be done with only ¼ grain morphine as preoperative medication, and no anesthesia.

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CLOSTRIDIUM TETANI IN CIVILIAN INJURIES

Eleven cases of civil wounds out of a total of 2,493 in which debrided tissues were studied yielded B. tetani. Five of these wounds involved compound fractures, 5 involved lacerations, and 1 was caused by a burn. Up to the time of writing none of them had developed tetanus. One case of tetanus developed following a burn in which B. tetani was not recovered from the debrided tissues.—HALL, I. C.: Occurrence of bacillus histolyticus in accidental wounds without recognized specific infection. Surgery 18: 369-388, September 1945.

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C. ANESTHESIA ON A HOSPITAL SHIP

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This article is an attempt to present briefly the experience with and some of the problems of anesthesia aboard a hospital ship. Anesthetics were limited, as neither cyclopropane, ethylene, nor pontocaine hydrochloride were available. All types of anesthetics for block and regional anesthesia were available, as was nitrous oxide-oxygen, and ether, both with a closed gas machine and by the open drop method; there was also intratracheal equipment.

As undoubtedly has been found by others handling war casualties, the largest percentage of patients were those who had injuries involving bones. This factor influenced the type of anesthesia used. Of all the patients requiring surgical treatment of some nature, the following types of anesthesia were used in 1,769 cases.

Pentothal	1,269
Spinal	144
Local	273
Spinal (and N_2O or pentothal)	16
N_2O and ether (general)	56
Local and N_2O	10
N_2O	1

Patients were handled on the ship from four major invasions, and because of the various stages of treatment which they had received, according to the length of time since their injury, certain arbitrary rules were followed in preparing these patients for surgery.

All patients showing signs of primary or secondary shock were treated immediately by a special shock team. Patients were not ordered to surgery until they had a sustained systolic blood pressure of 100 and a hemoglobin concentration of 70 percent or above. However those who needed surgery to stop frank hemorrhage were taken to the operating room and shock measures started and carried on during the procedures on the table. Whole blood and plasma were the agents most frequently and freely used at this time, and once the source of hemorrhage had been corrected it was fairly easy to return the blood volume and pressure to safe limits.

The preoperative medication was usually morphine sulfate, ¼ grain, and atropine sulfate, 1/150 grain, administered at least 30

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to 45 minutes before surgery. This preoperative medication was found to be adequate and seldom had to be varied.

The major abdominal work was done predominately with nitrous oxide induction, and ether with the closed carbon dioxide absorption method, using a gas machine. This method proved to be the most satisfactory because of the character of the operations performed. A large percentage of the abdominal wounds were found to be quite complicated, and the operating time was from 1½ to 3 hours; thus spinal anesthesia would be inadequate. Those cases which were a combination of chest and abdominal injury were handled by general (ether) and intubation anesthesia, which allowed direct and complete control of respiration.

Local and regional anesthesia was limited, mainly because of the extensiveness of the wounds. Local anesthesia was limited largely to operations about the head and neck and the removal of small fragments beneath the skin.

A combination of a local anesthetic and nitrous oxide was used on some sucking wounds of the chest with satisfactory results. Others were done with a local anesthetic and oxygen to supply positive pressure in order to help reinflate the lungs.

Pentothal sodium was the anesthetic most frequently used; it was the anesthetic of choice because of: (1) The ease and rapidity of induction; (2) the large volume of cases that could be handled with a relatively small amount of equipment; (3) the tolerance of patients, in near shock, to the drug; and (4) the absence of post-anesthetic disturbances, such as nausea and vomiting. Then, too, assistants to aid in administering anesthesia may be more easily and satisfactorily trained in the use of pentothal sodium than in some of the more complicated anesthetic procedures.

One other factor, which was important only from the patient's standpoint, was that many patients had to have two or more operative procedures done, and they did not dread succeeding anesthetization with pentothal. Because of the large amounts of pentothal sodium used and the number of anesthetics given in a day, the usual methods of preparing the drug were found to be inadequate. As much as 4,000 or 5,000 cc. of a 2-percent solution of pentothal was used in one day.

There were available a number of empty plasma bottles which held 400 cc. of solution. These were sterilized and each bottle was filled with 400 cc. of sterile distilled water and sixteen ½-grain ampules of pentothal sodium.

A 19-gage needle was then inserted in the stopper, with a sterile 4- by 4- protective pad placed over the needle. A bottle of solution so prepared was placed on the anesthetic table in each operating

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room. To complete the setup, trays holding from eight to ten 30-cc. syringes with intravenous needles were included. As the operation progressed and it was found that more drug might be needed, additional syringes could be filled.

The drug was administered by the intermittent dose method while the patient counted. As soon as the patient lost consciousness, the drug was given only as indicated by the usual signs of movement and phonation. This administration was by choice quite slow, because it was found that with most patients from 5 to 10 cc. of 2-percent solution was adequate to obtain the light surgical plane. In one instance 1 cc. of the 2-percent solution was adequate to produce anesthesia; a total of 7 cc. was used for 45 minutes of surgery. This was used with a combination of 50-50 nitrous oxide and oxygen. The average quantity per case seemed to be from 30 to 75 cc. of a 2-percent solution of the drug. The operating time varied from 5 minutes to 3½ hours.

Oxygen was not used routinely but only when it was thought the respirations should be supported. However an adequate airway was always maintained and closely watched. The rate and volume of respirations were the main criteria for the need of oxygen. Oxygen was used alone or with nitrous oxide. Used alone, it was given by a gas machine or by nasal catheter. If nitrous oxide was used in conjunction with the oxygen, a 50-50 mixture was used.

Nikethamide in adequate amounts was kept in each operating room, and when used as an antidote was administered intravenously, the amounts ranging from 3 to 10 cubic centimeters. It was also used therapeutically on many patients who seemed somewhat depressed at the close of the operation. When this was noted, from 3 to 5 cc. was given intravenously before the patient was removed from the table.

Pentothal sodium was used in a wide variety of cases, covering simple procedures such as incision and drainage of abscesses, to complicated, compound bilateral fractures of the femur with extensive loss of soft tissue. The tolerance to this drug of patients who were considered poor surgical risks was very good, and in many cases it was believed to have helped prevent impending shock. Both the surgeon and the anesthetist developed a degree of tolerance to slight movement of the patient as long as it did not materially interfere with the surgical procedure. Because of the type of injury and the general condition of the patient, the lightest anesthetic possible was considered best for the patient. In addition, the anesthetic was discontinued as early as possible. For example, when a cast was being applied following debridement and removal of fragments, as soon as the cast was started the drug

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was discontinued. Thus, as a rule, by the time the patient had left the operating room he had recovered most of his reflexes and was able to protect himself.

In this series of 1,269 operations under pentothal sodium, only two patients showed any intolerance to the drug, both having marked laryngeal spasm that was overcome by nikethamide and oxygen. There were no deaths due to this drug, nor were any deaths attributed to an anesthetic in the entire series.

The anesthesia for the surgery done on board this ship was conducted with the purpose of trying to fit the best possible agent available to the surgical procedure to be done. Because the work was largely orthopedic in nature, or complicated by orthopedic problems, penthothal sodium proved to be the agent of choice. It was found to be highly adaptable to a wide variety of procedures, and proved to be safe to handle in poor risk patients. It also saved much valuable time when time was such an important factor.

D. MEDICAL PROBLEMS OF AN INTERNIST ON A HOSPITAL SHIP

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The Reserve internist, if he is relatively new to the Navy and has never been to sea, may contemplate duty on a hospital ship with some uncertainty or even apprehension. Aside from the adjustment to the ship's routine, which is unfamiliar to him, he may feel that he will be called upon to do surgical work for which he is not qualified, or to treat bizarre tropical diseases with which he is unfamiliar.

It is our purpose, in this exposition of our experience, to give to those internists who may follow us a clearer idea of the problems they are likely to meet in this type of duty. Discussion of medical diagnostic and therapeutic problems is omitted because these are not peculiar to this type of duty.

A hospital ship's general functions are of two kinds. She may operate as a station hospital for the fleet in some port or anchorage where adequate hospital facilities are not available ashore; or she may accompany a combat force to a beachhead, or other zone of

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active fighting, there to receive casualties fresh from the front lines.

Duty as station hospital ship.—In some quiet atoll or other anchorage well behind the active fighting zones, a hospital ship may be at anchor for months, surrounded by any number of other vessels of the service and combat forces whose personnel equal in number the population of a good-sized city. Most of these ships have limited medical facilities and, as in any city, a certain number of the personnel have medical problems requiring hospital facilities for diagnosis or treatment. These patients are referred to the various services on the hospital ship either for consultation or for admission.

In a representative 3-month period of station hospital duty, 327 patients were referred to the medical service of this ship for consultation. Of these, as in civilian practice, the majority were suffering from psychosomatic disorders, and the commonest complaints were gastro-intestinal symptoms and headache.

During the same 3-month period, 121 patients were received for admission to the medical wards. In the accompanying table the diagnoses and disposition of these patients are tabulated; the list is notable chiefly for the absence of those exotic and little understood diseases of the tropics which one might expect would be a problem on ships stationed in equatorial latitudes.

Three-fifths of the patients admitted were evacuated, mostly by air, to base hospitals for further study and treatment, and the remaining two-fifths were returned to duty. Of the latter group, 64 percent were discharged within 1 week and 92 percent within 2 weeks. There was one fatality.

Six patients were transferred to base hospitals with the diagnosis undetermined. One of these apparently had recently had rheumatic fever, but there was no evidence of it when he was admitted here. Another patient had ascites, presumably due to cirrhosis of the liver. The third patient had a 6-month history of recurrent hemoptysis without fever or weight loss. X-ray examination of his lungs showed changes consistent with either tuberculosis or early neoplasm. The fourth patient gave a history of "seizures" of weakness and numbness associated with temporary loss of peripheral vision. He was considered as probably hysterical. The fifth had a tremor and weakness of the right hand and arm, with twitching of the muscles of the shoulder girdle and both upper extremities, associated with considerable emotional tension. His disorder was probably also psychogenic. The last patient had an obscure neurologic condition. As it was essential at that time to keep the wards as empty as possible, and as these patients

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clearly required prolonged treatment, they were evacuated to various base hospitals without a definite diagnosis being established.

This phase of duty on a hospital ship differs only in detail from civilian hospital practice.

Duty with a combat force.—It is difficult to describe accurately the function of a hospital ship in connection with the assault on enemy territory, because the treatment and evacuation of casualties depend, to some extent, on the nature of the combat operation,

Diagnosis and disposition of 121 patients admitted to medical wards in a 3-month period

	Number of cases	Disposition	
		Duty	Evacuated
Adenoma, thyroid, nontoxic	1		1
Albuminuria	1	1	
Arthritis, acute	2	1	1
Arthritis, chronic	3		3
Arthritis deformans	1		1
Asthma	3		3
Atrophy, progressive spinal, muscular	1		1
Blast, concussion	3		3
Bronchitis, acute	1	1	
Calculus, renal	1		1
Carcinoma, rectum	1		1
Cellulitis	2	2	
Diabetes	1		1
Encephalitis, acute (patient died)	1		
Effort syndrome	1		1
Endocarditis, subacute bacterial	1		1
Enteritis, acute	5	4	1
Enterocolitis, acute	2	2	
Fatigue, combat	4		4
Fatigue, operational	2		2
Gastritis, acute	1		1
Gastroenteritis, acute	3	3	
Fever, cause undetermined	2	2	
Heat exhaustion	1	1	
Hepatitis, acute	1	1	
Hemoptysis	1		1
Lymphangitis	1	1	
Malaria, benign tertian	2	2	
Malnutrition	1		1
Meningitis, cerebrospinal, acute	1		1
Migraine	1		1
Myositis, chronic plantar	1		1
Myositis, bilateral	1		1
Neuralgia, intercostal	1	1	
No disease (medical observation)	10	10	
Pleurisy, fibrinous, chronic	1		1
Pleurisy, serofibrinous	2		2
Phlebitis, saphenous vein	1		1
Pneumonia, broncho	2	2	
Pneumonia, primary atypical	7	5	2
Pneumothorax, spontaneous	1		1
Poisoning, acute (methyl alcohol)	4	2	2
Psychoneurosis, intestinal	1		1
Psychoneurosis, neurasthenia	1	1	1
Psychoneurosis, situational	1		1
Psychoneurosis, unclassified	2		2
Rheumatic fever	2		2
Silicosis	1		1
Smoke inhalation	3		3
Submersion, nonfatal	2	2	
Thrombosis, coronary artery	1		1
Tonsillitis, acute	1	1	
Tuberculosis, pulmonary, chronic active	8		8
Tuberculosis, active pneumonic	1		1
Ulcer, duodenum	5		5
Ulcer, stomach	1		1
Undulant fever	1	1	
Urticaria	1	1	
Diagnosis undetermined	6		6
Total	121	47	74

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and no two combat operations are exactly alike. In any case, however, the internist's duties are the same. They include (1) organization of the wards for which he is responsible; (2) immediate treatment of critical casualties; (3) evaluation of his patients' need for surgical treatment; (4) the general care of all patients; and (5) preparation of the required records.

The first of these, ward organization, should, of course, be completed long before the beachhead is approached, and the duties of each person assigned to the ward clearly understood by all concerned. The personnel assigned to a 55-bed ward on this ship consisted of a nurse and 6 hospital corpsmen.

One corpsman, previously trained in intravenous technic, gave all the plasma and intravenous fluids ordered by the medical officer in charge. (A special shock team gave the transfusions.) A second corpsman was assigned to take the blood pressure, temperature, and pulse and respiratory rates of each patient as soon as he was in his bunk, and this corpsman was instructed to notify the medical officer if any patient's systolic blood pressure was less than 95 millimeters of mercury.

A third corpsman was detailed to assist the medical officer in applying dressings and splints. It was his responsibility to keep on hand at all times an adequate supply of medical stores for this purpose. As most of the patients had to be treated and have their dressings changed in their bunks, it was found advisable to have a sizeable box constructed in which assorted dressings, sterile instruments, vaseline gauze, sulfanilamide crystals, tincture of benzoin, and acetone or carbon tetrachloride, could be carried from bed to bed. A covered pail for soiled dressings was also required. The fourth corpsman was assigned to the ward galley where, under the supervision of the nurse, he dispensed the special and regular diets which were prepared in the diet kitchen and general mess.

The remaining two corpsmen were available for general care of the patients under supervision of the nurse. The immediate need of the patients for adequate fluid intake was stressed, and when possible a corpsman made rounds of the ward every hour with water. If it seemed advisable, and it often was in hot weather, salt was added to the water periodically.

The ward, organized as outlined above, has been found to function satisfactorily except when patients are received too rapidly. Then all hands are required to get the patients out of their clothes and into their bunks and to keep the decks and passageways clear. As this ship has been fully loaded in anywhere from 4½ hours to several days, it is obvious that this factor will be reflected in

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the operation of the wards during the first few hours. There is a limit to the speed with which patients can be transferred from stretcher to bunk. They must be handled with due regard for their wounds and to the pain and shock induced by manipulation. It has been found advantageous to have on hand a large scissors for cutting off clothing, and it is also of importance that during this procedure the patient's personal effects be removed from the pockets, placed in an envelope, labeled, and properly safeguarded.

The medical officer's first duty when casualties begin to come aboard is the immediate treatment of the critically wounded. From a military viewpoint, the "critical casualty" is not the definitely moribund patient but the man who, because of bleeding, or an abdominal wound, or because he is in shock or respiratory distress, will be moribund in a short time if he is not treated promptly. The medical officer, therefore, must be watching constantly for evidences of these conditions.

External bleeding can usually be controlled, at least temporarily, on the ward by the usual first-aid measures of application of pressure dressings, packing, elevation of the part, application of ice packs or, as a last resort, a tourniquet.

The early diagnosis of perforating abdominal wounds is not always easy and may require, in addition to careful observation, an x-ray examination for localization of the missile, and a catheterized specimen of urine for evidence of injury to the urinary system. The importance of early diagnosis in these cases lies in the fact that the period when surgical treatment is of value is generally agreed to be only a matter of hours. In making the diagnosis, wounds of the buttocks and back which penetrate the abdominal cavity are most likely to be overlooked until it is too late. When a perforating abdominal wound is discovered, the surgeon should be notified immediately and if, after consultation, an operation is decided upon, the preparation of the patient for operation is of utmost importance.

The detection of shock should be a constant consideration. It is essential to recognize that shock is a labile state which may fluctuate quite rapidly and become resistant to treatment if permitted to persist. On this ship, when a patient's general appearance, his blood pressure, and laboratory evidence of hemoconcentration indicated that he was in shock, the medical officer in charge of the shock team was notified and treatment was carried out under his direction.

The commonest causes of respiratory distress in battle casualties are wounds of the chest, neck, and oral cavity. Small sucking wounds of the chest may be treated with an airtight adhesive

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dressing, and usually close off satisfactorily. Larger wounds, or wounds which continue to bleed into the pleural cavity, must be treated promptly by surgical means. When respiratory distress or cyanosis persists with the patient at rest, an immediate thoracentesis should be done if considerable fluid is demonstrated in the pleural cavity or if there is a mediastinal shift away from the injured side. Oxygen by nasal catheter or mask, and small doses of morphine, are also indicated.

In wounds of the neck and oral cavity every effort should be made to prevent aspiration of blood and saliva. A portable suction apparatus is useful for this purpose and large doses of morphine should be avoided because of its depression of the cough reflex. A tracheotomy is not infrequently urgently required, even hours after the wound was received, because of progressive swelling of the injured parts.

When the treatment of critical cases has been attended to, a careful survey of all the patients is begun. At this time all wounds should be redressed and roentgenograms ordered when necessary, and those patients requiring surgical procedures should be listed according to the urgency of their need for treatment. Such classification is a matter of judgment and opinion, but in general fractures of the femur or humerus should be immobilized as soon as possible, and wounds of the arms or hands should take precedence over similar injuries to the legs and feet. When this process of evaluation has been completed, the list is submitted to the surgical service and an operative schedule made out.

The general care of patients is largely a nursing problem and requires little comment. Mostly it consists of the usual preoperative and postoperative measures, and the majority of patients receive either penicillin or sulfadiazine until they are free from fever or other evidence of infection. A urinary output of 1,500 cc. and alkalinization of the urine are of particular importance in patients taking sulfadiazine in tropical climates.

The writing of histories is usually most easily accomplished at the time the patients are first examined and the dressings removed. The history must of necessity be short, but whenever possible should include when, where and how the patient was wounded and a description of his injuries and any other abnormal physical findings.

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E. PERFORATING WOUNDS OF THE KIDNEY

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The purpose of this discussion is to relate briefly the experience with perforating wounds of the kidney on the U.S.S. *Samaritan*, to show the use of urologic diagnostic procedures in the clinical management of these patients, and to point out that major surgical procedures are rarely advisable in the treatment of this type of wound.

In more than 7,800 battle casualties treated aboard this ship from the latter part of June 1944 to the end of July 1945, the incidence of genito-urinary tract injuries (incurred from shell fragments and bullets) was low, constituting about one percent of all wounds. No perforating wound of the kidney was fatal during this period.

Men wounded by penetrating missiles in the region of the lower thorax, flanks, abdomen, lumbosacral spine, or the pelvic region were carefully examined to exclude urinary tract injuries. Attention, if one is not cognizant of a renal injury, may be centered on more obvious signs and symptoms, particularly since renal injuries may be symptomless. Concomitant injuries can be so commanding that a bleeding kidney or urinary bladder extravasation will progress unnoticed until bloody urine attracts attention. Therefore no examination was considered complete until a specimen of urine had been analyzed.

Once hematuria had been detected, it was imperative to know the extent and severity of urinary tract trauma. To differentiate between upper urinary tract and bladder injuries was not usually a problem. A perforation of the bladder or posterior urethra, often complicating an intra-abdominal or rectal injury, demanded early surgical treatment, whereas an uncomplicated kidney perforation was never considered an immediate surgical emergency.

Clinical management of renal perforation was based on the knowledge of the exact extent and severity of the renal injury. Men arriving from beachheads who had uncomplicated renal perforation were rarely in shock, whereas patients with kidney perforation complicating injuries of intraperitoneal organs were in shock. As soon as shock had been alleviated or treatment for shock had been instituted, patients with complicated renal injuries un-

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derwent an abdominal exploration. During the intraperitoneal examination, the kidneys were palpated. In no case was there sufficiently extensive renal maceration or perirenal bleeding to warrant subsequent lumbar exploration.

Patients with renal wounds were closely observed. The blood pressure and pulse were checked every hour or two. Red blood cell counts and hematocrit readings were frequently done. These determinations were used as indications for whole blood transfusions. Hematuria, even though gross, was not considered sufficient reason for early lumbar exploration. Profuse initial hemorrhage from the kidney does not indicate the degree of renal injury. In nearly all the patients with kidney wounds observed here, the urine was clear, or practically so, in from 36 to 48 hours.

When 600 severely wounded men were admitted from beachheads in a relatively short period of time, and it was known that these patients would receive care aboard this ship for from 3 to 5 days, time and emergency conditions did not always permit diagnostic x-ray studies. However intravenous pyelograms were carried out in the most urgent cases. Excretory urograms made when the patient is in shock are of no value and can be misleading. The posttraumatic kidney, in the absence of shock, often temporarily stops secreting, and intravenous urography will not yield visualization. These findings do not always signify renal maceration or that early surgical intervention is indicated.

Excretory urography aided in locating and defining the degree of renal injury and determined the presence and function of the opposite kidney. If the kidney excreted a fair concentration of dye, it was not considered too severely damaged or that early surgery was necessary. Occasionally intravenous pyelography did not present accurate enough information; then cystoscopy and retrograde pyelography were done to determine whether an early lumbar exploration was required. Roentgenographic indication for surgery depended upon the outline of the pelvis of the kidney. If the pyelogram showed the pelvic cavity to be intact, even though rupture of the parenchyma was evident, surgery was not contemplated. None of these patients with perforation of the kidney showed roentgenographic evidence or clinical signs sufficient to warrant renal exploration.

The conclusion from the experience here in treating patients with renal injuries is that early management should be conservative. The initial renal hemorrhage is rarely an indication for lumbar exploration, plastic repair, or nephrectomy. Surgery is indicated only when there is persistent or recurrent hematuria.

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F. PUNCTATE CEREBRAL HEMORRHAGE FOLLOWING THORACIC TRAUMA

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On this hospital ship two fatalities were encountered from symmetric, diffuse, punctate cerebral hemorrhage secondary to severe thoracic trauma and multiple fractures. The first case carried a diagnosis of atmospheric-blast concussion; the second case resulted from a fall.

The gross appearance of the brain from each of these patients was strikingly similar to the photograph used by Gonzales, Vance, and Helpern,[1] to illustrate their discussion of cerebral fat embolism. Histologic study of the two cases seen here revealed hardly any cerebral fat embolism as a basis for the punctate hemorrhages.

CASE REPORTS

Case 1.—A 20-year-old Marine private was transferred from a beachhead with the diagnosis of atmospheric-blast concussion. No history was obtained, because the patient was semiconscious and in shock. The blood pressure was 74/52. The right arm and right leg were in traction splints. The skin of the right anterior portion of the thorax and the right upper portion of the abdomen was discolored and contused. There were no perforating wounds of the body, but the abdomen was distended and the urine was grossly bloody. No external injury of the head was evident.

Transfusions of whole blood and plasma relieved the primary state of shock, but later secondary shock developed.

Roentgenograms revealed a comminuted fracture of the right acetabulum, and an oblique fracture of the shaft of the right humerus.

The patient never recovered consciousness, and he died on the fourth hospital day.

In the intervening period he had showed no evidence of perforated viscus, roentgenogram of the chest showed no lesions, and there were no localizing neurologic signs. The urine was grossly bloody, and a blood urea nitrogen determination was 42 milligrams percent. Shortly before the patient's death the axillary temperature was 102.2° Fahrenheit. The final hours were characterized by increasing dyspnea and cyanosis.

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[1] GONZALES, T. A.; VANCE, M.; and HELPERN, M.: Legal Medicine and Toxicology. D. Appleton-Century Company, New York, 1940. p. 98.

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Necropsy findings.—A bluish contused area was seen over the right anterior and lateral aspect of the thorax and the right upper part of the abdomen. Fracture of the right humerus was obvious, but there was no external evidence of the fractured right acetabulum. Complete fracture of the right fifth rib laterally had resulted in puncture of the parietal pleura and perforation of the lung. Both lungs were heavy, and the lower lobes were red. The lung tissue was filled with frothy fluid containing minute refractile globules which floated in water. There were numerous small hemorrhagic areas on the parietal pleura and peritoneum. Both surfaces of the diaphragm and the right upper abdominal parietal peritoneum were especially involved.

The epicardium contained a single small hemorrhagic area. A small quantity of blood-tinged fluid was present in each pleural cavity and in the pericardial cavity. Blood had extravasated into the fat of the anterior mediastinum. The posterior margin of the spleen was torn, and was the principal source of about 100 cc. of free blood in the peritoneal cavity.

A rupture, 3 cm. long, had occurred within the right lobe of the liver but the liver capsule was intact. There was focal bleeding into the transverse mesocolon and the peritoneum of the transverse colon. A small tear was present in the right side of the iliac mesentery. The medulla of the right adrenal gland was expanded by a hematoma. The left kidney contained a small focus of hemorrhage inferiorly, and the right kidney contained a small, fresh, anemic infarct in the upper pole.

No lesions were encountered in the scalp, calvarium, base of the skull, or the dura mater. The cranial nerves and the large veins and arteries of the brain were intact. The veins of the pia-arachnoid were engorged with blood, and the cerebrospinal fluid was blood-tinged.

In the brain, punctate hemorrhages were the salient feature. These foci were symmetrically disposed, and almost completely confined to the white matter of the cerebrum. Very few were present in the cerebral cortex, but the body of each caudate nucleus was involved, as was the midbrain near the substantia nigra. In the white matter of the cerebellum, and in the brain stem and the upper cervical segment of the cord, a few scattered minute extravasations of blood were seen. In general these foci were dark red.

The lungs contained extensive intra-alveolar hemorrhagic infiltrations in the lower lobes, and edema coagulum elsewhere. Many fat emboli, demonstrated with sudan III stain, plugged small pulmonary arteries and alveolar wall capillaries.

In one kidney the collecting tubules contained many red blood cells. There was also a moderate degree of degeneration of the convoluted tubule epithelium. Rare fat globules were demonstrated in glomerular capillary tufts and in one interlobular artery.

The medullary vein of the right adrenal gland was ruptured and thrombosed, and blood was extravasated into the medulla.

In sections of the cerebral white matter, the great majority of the hemorrhagic infiltrations surrounded a capillary or a venule. The extravasated red blood corpuscles were well preserved. Some of the involved capillaries were thrombosed. In no instance was a fat globule demonstrated within the lumen of a capillary or venule which was surrounded by hemorrhage. The white matter was rarefied in the foci of bleeding, but no phagocytic glial cells were present. In some of the hemorrhagic zones, a ring of astrocytes surrounded the central capillary.

No hemorrhagic infiltrations were seen around arterioles, although some of the arterioles and small veins were surrounded by a rarefied zone filled

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with edema coagulum. In several sections of the white matter, one fat globule was demonstrated within a capillary, but there was no bleeding around that vessel. The capillaries of the cerebral cortex were engorged with blood. They contained no fat globules. Droplets of fat were present in the cytoplasm of capillary endothelial cells and in the cytoplasm of neurons. The occasional hemorrhagic foci contained in sections of the brain stem and the caudate nuclei were similar to those in the cerebral white matter. The cause of death was considered to be traumatic punctate cerebral hemorrhage.

Case 2.—A 31-year-old medical officer was boarding a ship to attend casualties. In the darkness he slipped from the ladder and fell 25 feet into the boat below, landing on his right side. He experienced severe pain in the right thorax, dyspnea, and a slight hemoptysis.

When admitted 8 hours after the accident, the only complaints were those noted above. He had not been unconscious, and his sensorium was clear.

Physical examination showed an obese man of large stature, whose weight was 210 pounds. The right side of the thorax was tender and showed evidence of contusion, there was subcutaneous crepitation, and the breath sounds were diminished. The patient was not in shock. There was slight acceleration of the pulse and respiratory rates. No evidence of injury to other portions of the body was evident.

Roentgenographic examination showed fracture of the right third through eighth ribs posteriorly. An almost uniform opacity was present throughout the right lung field, suggestive either of free fluid or intrapulmonary hemorrhage.

Strapping of the chest relieved pain and dyspnea. The hospital course lasted 4 days. On the third day cyanosis developed and dyspnea reappeared. The patient became mentally dull. A chest tap resulted in the aspiration of 720 cc. of bloody fluid from the right pleural cavity.

On the fourth day the patient was comatose. The breathing was rapid and shallow, and the pulse rate was accelerated. There was no evidence of shock. No localizing neurologic signs were evident. A spinal tap showed normal pressure and dynamics. The only abnormality of the cerebrospinal fluid was a red blood cell count of thirty-six. A right thoracentesis was repeated and 250 cc. of bloody fluid aspirated. The urine was normal. There was a leukocytosis of 18,700; the differential count showed 78 percent polymorphonuclear leukocytes, and a slight shift to the left.

Coma deepened and pulmonary edema developed. The pupils became contracted in the absence of recent morphine medication. Throughout the hospital course the patient's temperature had increased about one degree each day. On the last day it mounted rapidly, and shortly before death the axillary temperature was 106.6° Fahrenheit.

Necropsy findings.—Externally the right side of the body presented an area having the appearance of contusion, which extended from the midthorax to the crest of the ilium. Subcutaneous crepitation was present over the right side of the thorax. Six ribs on the right side, the third through the eighth, were fractured at the angle. The parietal pleura was pierced by the ends of the fractured ribs, and there was a small perforation of the diaphragm. The right lung was atelectatic. Clotted blood covered the right pleura posteriorly, and 150 cc. of bloody fluid was present in the cavity. There were numerous pleural hemorrhagic infiltrations on both sides, but the left pleural cavity contained no fluid or blood.

The liver was lacerated at the site of the perforation of the diaphragm,

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but the defect in the liver was sealed by a hematoma. No blood was present in the peritoneal cavity. The transverse mesocolon contained a small hematoma.

There were no lesions of the scalp. The skull was intact. In the tentorium cerebelli there were two minute tears. The dura elsewhere was undamaged. The entire white matter of the cerebrum was symmetrically stippled with dark red punctate hemorrhages. A very few petechiae were present in the basal nuclei. Hemorrhages in the cerebral cortex were rare. The midbrain contained a cluster of petechiae in the region of the substantia nigra on the right side. A few scattered punctate hemorrhages were present in the white matter of the cerebellum, and in the pons and the medulla.

The right lung sections contained lobular areas of polymorphonuclear leukocytic exudation. Other sections of lung tissue showed edema coagulum in the alveoli, and alternate areas of atelectasis and emphysema. A few of the pulmonary arterioles contained fat emboli, and fat globules distended and plugged scattered alveolar wall capillaries. Fat embolism was of moderate degree.

Sections of the cerebrum, cerebellum, and midbrain contained punctate hemorrhages similar to those seen in case 1. These hemorrhages surrounded many of the capillaries and a few venules, but no arterioles. Some of these venules and capillaries were thrombosed. The surrounding white matter was rarefied. Some of the involved capillaries and venules were rimmed with astrocytes. There were no *gitterzellen* in the foci of bleeding.

Around some of the arterioles and small veins there were rarefied spaces which contained edema coagulum and a few cells which resembled lymphocytes. There was general engorgement of capillaries and venules with blood. Several sections of cerebrum, stained with sudan III, showed no fat embolism in the arterioles or capillaries of either the white matter or the cortex. In the cortex, the cytoplasm of capillary endothelial cells and of neurons contained fat droplets. The cause of death was considered to be traumatic punctate cerebral hemorrhage.

COMMENT

Two cases of punctate cerebral hemorrhage were seen. The first patient had been injured by atmospheric blast; he had an extensive right thoracic and abdominal contusion, right hemothorax, puncture of the right lung, one fractured right rib, a fracture of the right humerus and right acetabulum, rupture of the spleen and liver, hematoma of the right adrenal gland, renal bleeding, mediastinal hemorrhage, and hemorrhages into the serous membranes of the thoracic and the abdominal cavities. The second patient was injured by a fall from a height of 25 feet, which resulted in an extensive right thoracic contusion, fracture of six right ribs, right hemothorax and atelectasis (with terminal acute lobular pneumonia), puncture of the right diaphragm and the liver, and hemorrhages into the serous membranes of the pleural and abdominal cavities. Each case was characterized clinically by progressive coma, with no localizing neurologic signs.

Both patients showed pulmonary fat embolism. In the first case this was much more extensive than in the second. This difference

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is not surprising, because fat embolism is more prone to occur from fractures of long bones where fatty marrow predominates, than from fractures of flat bones where red marrow predominates.

A fat embolus was demonstrated in a capillary of the cerebral white matter in the patient cited in case 1, but it was not associated with hemorrhage. Fat embolism was not of sufficient degree to account for the multiplicity of the punctate hemorrhages. No fat embolism was demonstrated in the cerebral white matter of the patient in case 2. The method of preservation, section, and staining of the tissue was the same in each case.

It is contended that the brain hemorrhages in case 1 were not the result of atmospheric blast concussion per se. The right-sided distribution of the fractures and the contusion of the body indicate that injury was due to the patient being thrown against the ground or other object. This view is in line with the Tunbridge[2] classification of injuries from atmospheric blast concussion.

The problem remains to account for the diffuse punctate cerebral hemorrhage in the relative absence of cerebral fat embolism.

The hypothesis is presented that the force of the trauma to the thorax of these patients was transmitted to the venous circulation, and resulted in a retrograde wave of elevated venous pressure. The degree of force involved in these cases is, we believe, sufficient to overcome the barrier of the one set of venous valves located near the termination of each internal jugular vein. From that level to the capillaries of the brain there are two direct, relatively short columns of blood, unprotected by venous valves.

A review of the venous circulation of the brain and the dural sinuses[3] suggests several factors which may explain the relative confinement of the brain hemorrhages to the cerebral white matter. The most abrupt change in vessel caliber is from the capillaries of the cerebral white matter and the basal nuclei to the great cerebral vein. The venous tract from the capillaries of the cerebral white matter, basal nuclei, and upper midbrain to the confluence of the dural sinuses is more direct, and is generally shorter, than the tract from the capillaries of the cerebral cortex to the confluence of the sinuses. The angles at which the superior cerebral veins enter the superior sagittal sinus, and the presence of folds of dura in relation to the ostia of these veins, would tend to lend protection to the capillaries of the cortex from a retrograde wave of pressure.

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[2] TUNBRIDGE, R. E.: Cause, effect, and treatment of air blast injuries. War Med. 7: 3-6, January 1945.

[3] LEWIS, W. H.: Gray's Anatomy of the Human Body. 24th edition. Lea & Febiger, Philadelphia, 1943. pp. 654-661.

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Furthermore the capillary bed of the cerebral white matter is relatively sparse as compared to the richness of the cortical capillary bed. This factor would allow much less dispersion of a retrograde venous pressure wave in the capillaries of the cerebral white matter than in the capillaries of the cortex. The middle and inferior cerebral veins drain into the smaller dural sinuses, and would not be subject to the full effect of a pressure wave.

In brief, a retrograde wave of venous pressure should strike the capillaries and venules of the cerebral white matter before it strikes those of the cerebral cortex. The force should be less readily dispersed in the white matter than in the cortex. The same applies to the basal nuclei and the proximal portion of the midbrain. The capillaries of the cerebellum and the remainder of the brain stem should be protected from such a force by the relative complicity of the veins and the dural sinus system. This hypothesis should be subjected to experimental study; however the operational schedule of the ship has not been conducive to experimental research.

That in each subject the cerebral hemorrhages were of varying age is indicated by the presence of a glial reaction in some hemorrhages and its absence in others. It is believed that the hemorrhages were progressive and probably resulted from slow seepage, after the initial damage to the capillaries and the venules. The progressive clinical course coincides with this view.

SUMMARY

1. Two fatal cases of punctate cerebral hemorrhage associated with thoracic trauma and multiple fractures are presented.

2. Pulmonary fat embolism was present in each case.

3. There was insufficient cerebral fat embolism to account for the degree of punctate hemorrhage.

4. It is hypothesized that the cerebral hemorrhages were the result of a retrograde wave of venous pressure which damaged capillaries and venules.

5. Factors are presented regarding the anatomy of the venous system of the brain which offer an explanation of the relative confinement of the hemorrhages to the cerebral white matter.

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G. INJURIES OF THE FACE AND NECK IN WAR CASUALTIES

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This is a report of neck and face injuries treated aboard this hospital ship. Multiple injuries are the rule in war casualties, making it imperative to examine the patient thoroughly before any surgery or therapy is instituted. There are frequently associated injuries of the chest, abdomen, and extremities in head and neck cases, and very often the more obvious injuries are treated before those which are more dangerous to the life of the patient.

The urgent problems encountered in injuries of the head and neck are shock, hemorrhage, and respiratory distress. It was very often necessary to take the patient directly to the operating room for the arrest of hemorrhage or for tracheotomy or for both. A minimum amount of anesthetic was administered, local being used whenever possible. Whole blood and plasma were administered to the patient in the operating room when indicated. Any work which did not come under the urgent classification mentioned above was postponed until the patient had been thoroughly examined and his condition evaluated. Rest, sedation, blood plasma, and fluids were all important. At the end of 24 or 48 hours the patient was invariably in much better condition for anesthesia and surgery.

Patients on whom it was necessary to perform a tracheotomy required special care. Oxygen tanks were ready for use at all times on the ward where these patients were treated. Suction was available for immediate use. Nurses and hospital corpsmen in charge were instructed in the care of these patients. A small rubber catheter was secured to the patient's bunk in a sterile towel. The tracheotomy tube was kept clear of mucus, and the inner tube was removed and cleaned every hour. The patients were turned from side to side whenever possible to allow mucus to run out of the corner of the mouth rather than to collect in the oral pharynx and cause aspiration and coughing. Change of position also aided in preventing pulmonary congestion. All who needed such attention were kept in one section of the ward. One corpsman, when possible, was detailed to these patients. Constant attention showed very gratify-

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ing results; lack of attention could have proved quite disastrous.

For the first 24 or 48 hours no attempt was made to give the patient fluids by mouth, feeding being entirely by the intravenous route. It should be mentioned here that continued use of saline and dextrose will raise the blood chlorides to a level which will maintain or increase edema. Dextrose in distilled water in conjunction with plasma or whole blood was substituted when it was necessary to use intravenous feeding alone for more than 2 days. A nasal feeding tube was inserted as soon as the patient's condition allowed. A high protein liquid feeding every hour proved very satisfactory. No more than 8 ounces were given at each feeding. Overfeeding may cause regurgitation with immediate or subsequent complications. The tube was often a source of annoyance to the patient. It was left in place for as many feedings as possible and removed in the evenings.

Many patients showed great improvement after the third or fourth day. Small liquid feedings by mouth were possible, under close supervision, at this time. Penicillin, 20,000 units every 3 hours, was given routinely to all patients in this category. Tetanus toxoid was also given, 0.5 cc. intramuscularly, if there was no record of the patient having received it after the injury.

The conditions for which tracheotomy may be necessary are frequently encountered in war wounds about the head and neck. Occasionally fixation of a badly comminuted compound fracture of maxilla, mandible, or both, obviated the necessity of a tracheotomy. Gunshot or bayonet wounds of the face or neck may embarrass respiration. It is best not to procrastinate if definite signs of upper respiratory obstruction are present. What early may be a careful surgical procedure may later be an emergency. The cause of dyspnea may be edema, loss of substance with loss of support of the tongue, or direct injury to the larynx or trachea. Whatever the cause, an adequate airway must be established and maintained. Respiratory distress may be central in origin or the result of injury to the chest. By careful physical and x-ray examination no difficulty should be encountered in arriving at a differential diagnosis. There were a few patients in whom a combination of central depression and obstruction of the upper respiratory tract were present. In these patients a tracheotomy was necessary, although the prognosis was obviously poor.

It might be well to mention a few points to be kept in mind in doing a tracheotomy. The so-called high tracheotomy should never be done. In reality it is a laryngotomy done through the cricothyroid membrane, and often results in perichondritis and laryngeal stricture with obvious sequelae. In doing a tracheotomy

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the head was held in the midline, extended as much as was compatible with the patient's condition, and a sandbag placed under the shoulders to aid in obtaining the desired amount of extension. Local anesthesia was used, 1- or 2-percent procaine hydrochloride being injected in the midline. Incision in the skin was made from the thyroid notch to the sternal notch in the midline.

It was seldom necessary to ligate and divide the isthmus. Careful dissection was done around the trachea to avoid any possibility of a mediastinitis. A longitudinal incision in the trachea was made through the second and third cartilaginous ring. Care was exercised that no damage occurred to the posterior wall of the trachea. Suction apparatus was ready for use, as much mucus was usually encountered when the trachea was opened.

A tracheal spreader was used and a tracheal tube No. 4 or 5 inserted. A packing was placed in the lower end of the wound to prevent emphysema and to insure good exposure of the tracheal opening when it was necessary to change the tube. The upper end of the incision was closed with silk sutures, and the tracheotomy tube fastened in place. The inner tube was removed and cleaned every hour by the nurse or corpsman. The outer tube was changed by the medical officer under operating conditions, usually after 48 hours. The outer tube was changed daily thereafter while the patient was aboard. Decannulization was done in the usual manner as soon as it was feasible. It was possible to remove the tube in four patients carried on one trip; however the time aboard (an average of 4 days) was too short in most instances to attempt removal of the tube.

Patients often were brought aboard with a tracheotomy tube in place. They were inspected as soon as possible and the tube changed. Most patients treated on the beach had only the outside tube in place. The inner tube had been retained by the medical activity ashore to maintain on hand as many airways as possible for future needs.

Occasionally a patient was admitted with an intratracheal rubber airway in place. One patient when brought aboard had had such an airway in place for 3 days. He had a compound comminuted fracture of the lower jaw. The oral cavity and oral pharynx had been packed to control bleeding. A lifesaving job had been well done. It is better, however, if at all possible, to establish an airway below the obstruction early, so that the tube may be removed from between the cords in time to avoid permanent damage to the larynx.

Occasionally more work was necessary on admittance than was desirable, but no intermediate or shorter procedure would suffice.

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Case report.—A patient with a badly lacerated chin and floor of the mouth, with considerable loss of anterior segments of the mandible, was brought aboard bleeding profusely, having great respiratory difficulty and being very apprehensive. Well aware of the dangers involved, it was necessary to start sodium pentothal anesthesia on this patient while he was in a semisitting position. When he was relaxed, an intratracheal catheter was inserted and nitrous oxide and oxygen was substituted for the sodium pentothal. Continuous oral suction was used to prevent aspiration during induction.

After the introduction of the intratracheal catheter, the oral pharynx was packed with gauze. A tracheotomy was done and oxygen was then administered through the tracheal tube. Because of the loss of substance of the lower jaw and floor of the mouth, the tongue had no support, which was the main cause of the respiratory distress. To correct this it was necessary to apply arch bars to the remaining teeth, and rubber-band traction to re-establish a lower arch. The vessels which were accessible were tied off and a pack was inserted in the floor of the mouth anteriorly. The through-and-through laceration of the lip was repaired and a through-and-through drain at the lower angle of the wound was sutured in place. Local anesthesia was used for all the work on the floor of the mouth and the lip. The patient's condition when leaving the ship was satisfactory.

The course of a bullet as determined by the point of entrance and exit did not indicate that the damage caused was limited to its path. The transmitted explosive force in passing through the tissues caused, in many instances, serious remote damage. The location of shell fragments in tissues of the neck or elsewhere was difficult to ascertain. X-ray examination was a great help but often misleading unless the roentgenograms were carefully interpreted by a competent roentgenologist. The fluoroscope used judiciously was often a great aid in locating and removing foreign bodies. Unless great care is exercised in its removal, more damage may be done by a fragment on the way out than was caused while it was lodged in the tissue. Severe bleeding, very difficult to control, may be encountered when the removal of ragged foreign bodies is attempted blindly.

Other neck injuries of primary importance which may or may not be associated with trauma to the upper respiratory tract are:

1. Perforation or trauma of the esophagus with subsequent mediastinitis.
2. Injury to the cervical or upper thoracic cord.
3. Damage to the large vessels of the head or neck.
4. Brachial plexus injury.
5. Chest injuries.

Perforation of the esophagus should be suspected in all cases in which the larynx or trachea has been injured. It may be possible to damage the esophagus by external violence without injury to the larynx or trachea, but we encountered no such case. Restricting fluids by mouth and tube feeding is a good policy with all

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patients in whom any damage to the esophagus is suspected, until x-ray and clinical evidence indicates that the esophageal mucosa is intact. The following case illustrates this point:

Case report.—This patient had a shell-fragment wound of the neck for which a tracheotomy had been done on the beach about 6 hours before admission. He had no respiratory distress and was taking fluids by mouth. His clinical course on the ship was uneventful until the third day when difficulty in swallowing became evident. An attempt to pass a feeding tube was unsuccessful. No fluids were allowed by mouth and intravenous therapy was instituted. A bulge in the posterior pharyngeal wall could be felt by the finger inserted in the oral pharynx. An x-ray picture revealed evidence of a large amount of air which dissected the prevertebral fascia.

With a blunt hemostat, an opening was made in the posterior pharyngeal wall through which a foul-smelling, brown, watery discharge escaped under pressure. The release of this fluid relieved the patient of his acute distress. External drainage was thought advisable, but the patient's general condition would not warrant an operation at this time. He became irrational, showed signs of pulmonary congestion, and expired 12 hours after the opening had been made in the pharyngeal wall. Necropsy findings included a perforating wound of the trachea; tracheotomy at the site of wound; contusion and perforation of the posterior wall of the esophagus; extensive dissecting of the infected tract of the prevertebral region of the neck and mediastinum; surgical incision in the posterior pharynx; apparent acute tracheitis and bronchitis; and evidence of acute aspiration pneumonia.

The prognosis in this case was, of course, bad; however no fluids by mouth, feeding only by tube, early x-ray examination, and early external drainage, if indicated, would have been the treatment of choice.

Many patients were admitted to our wards because of obvious neck wounds. The damage done to the tissues of the neck was minor, but on general physical and neurologic examination, injury to the cervical or upper thoracic cord was revealed. In a number of cases complete section of the cord had occurred. These cases were handled by the orthopedic and general surgery sections. The urologist was consulted as to the care of cord bladder.

Damage to the large vessels of the neck must be suspected, no matter how small the point of entrance of the foreign body. One patient who came aboard in good condition had had a tracheotomy done on the beach, and an adequate airway was present. There was a small wound on the right side of the neck over the lower third of the sternocleidomastoid muscle, in which gauze packing had been inserted. An x-ray examination was ordered for the following day to determine the presence and location of a foreign body. On the evening of admission, a severe hemorrhage occurred and the patient expired in a matter of minutes.

The importance of keeping quiet and limiting the movement of the neck as much as possible should be stressed. Sedatives should

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be administered and the patients restricted to bed.

Case reports.—It was necessary in one instance to ligate the external carotid artery. The patient was admitted with a ragged hole about 2 cm. below the right mastoid tip. Bright red blood was oozing from the wound when the battle pressure dressing was removed. There was every indication of a large hematoma being present. Packing was inserted in the wound, pressure dressing was reapplied, the head was elevated, ice was applied to the neck, and morphine was administered. The patient was rational and the general condition appeared consistent with severe trauma. The only other positive physical finding was a weakness of the entire left side.

About 6 hours after admission he had a severe hemorrhage from the mouth as well as from the neck wound. Hemorrhage was controlled by a postnasal pack and pressure dressing. A unit of blood and plasma was given, and under local anesthesia the external carotid artery was ligated. A ligature was also placed around the common carotid but not tied, the ends being brought out through the incision. The packings were removed from the nasal pharynx and also from the neck wound, with no bleeding encountered. Examination shortly after he was returned to his bunk revealed a left hemiplegia. He became comatose and expired 12 hours after operation. Necropsy findings included: Wound, shell fragment, of the right side of the neck, penetrating the right pterygopalatine fossa; traumatic arteriovenous aneurysm of the right internal carotid artery, middle cerebral artery and jugular vein; infarction of the right cerebral hemisphere, involving especially the basal ganglia and the temporal cortex, and recent ligation of the external carotid artery.

Since the thrombotic occlusion of the right internal carotid artery did not extend down to the level of the aneurysm, it is possible that there was first embolic occlusion of the artery distally, originating from the thrombus in the aneurysm, and then retrograde thrombosis of the artery.

One patient admitted to our service had a small shell-fragment wound just to the left of the midline at about the level of the second or third tracheal ring. He had an anxious expression, was apparently in much pain, and had considerable respiratory distress. There was no evidence, however, of upper respiratory obstruction. Respirations were rapid, the right side of the chest was splinted, and the abdominal muscles were rigid. X-ray examination revealed a fragment, about 1½ cm. in diameter, in the periphery of the right lung. There was evidence of a small amount of fluid at the base, and the lung was about four-fifths expanded. The patient was given oxygen, placed in a semisitting position and given sedatives. Conservative treatment yielded good results. The foreign body was not removed while aboard ship and it was not necessary to tap the chest. When the patient left the ship in 4 days he required no oxygen, the respirations were not labored, and pain was greatly reduced.

FACIAL INJURIES

It is again emphasized that obvious facial injuries may be associated with cord damage, injury to the larynx, trachea, pharynx, esophagus, or large vessels in the head or neck. It is well established also that every severe facial fracture should be considered a basal skull fracture until proved otherwise.

The treatment of facial wounds follows as closely as is feasible

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the accepted pattern of treatment of all war wounds. Tight closure (closure without drainage) of facial wounds should never be done. It was necessary to remove sutures, establish drainage, and apply continuous wet soaks to practically every case which had been so closed before the patient was received aboard this ship.

Approximation of the wound, with drainage, following careful cleansing and conservative debridement, was done as soon as possible. In some cases approximation with drainage was done when the patient was first seen a few hours after injury. It was necessary in other instances to postpone closure for 2 or 3 days, either because of the general condition of the patient or the contamination of the wound. Continuous wet saline solutions were applied until such time as the laceration could be repaired.

Excision of ragged skin edges, complete hemostasis, adequate drainage, the use of a minimum amount of catgut, and the insertion of fine skin suture material for the approximation of skin edges will, it is believed, yield the best results. Wherever possible a pressure dressing was applied. Many of these cases will require secondary plastic repair; however the above outlined treatment should aid materially in obtaining a good end result.

Dirt, powder marks, or other pigmented material required careful removal from facial wounds. In superficial wounds of the face the use of a stiff brush with soap and water may prevent tattooing, which is very disfiguring and impossible to remove later except by excision. General anesthesia was required for this procedure.

Patients received aboard on one trip had many small pieces of lava embedded in the soft tissue of the face. The use of soap and a scrub brush did not remove the embedded particles, making it necessary to remove them by many hours of tedious work, but the results obtained justified the time spent.

In other instances coral was found embedded in the soft tissue of the face and also in the antra. In an x-ray film, coral is very difficult to distinguish from bone. If there is an associated fracture with many bone chips, only careful examination of the film will enable the roentgenologist to differentiate the two. Coral may be very irritating and was removed as soon as possible. After removal of the large pieces, irrigation and suction was used to remove the remaining particles. The area involved was left open and a drain was sutured in place. After removal of coral from the antrum, the sinus was irrigated and packed open.

Foreign bodies should be considered embedded in all war wounds unless proved otherwise. All patients receive roentgenographic examination to determine the presence of metallic foreign bodies. When possible the removal of a foreign body through the point

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of entry should be done carefully before closure of the wound. This is much easier to accomplish early. It may be advisable, if the patient is not seen before a week or 10 days, to wait, and at a later date remove the foreign body through a clean incision and a more direct approach. There can be no rule in this regard. The location of the foreign body, the patient's symptoms, and the danger involved, are all weighed and the operator's course governed accordingly.

When there was marked loss of substance, we have sutured the skin to the mucous membrane after cleaning and debridement. Healing is facilitated by covering all raw surfaces.

It is often possible to shorten by many months a patient's hospitalization, by early repair of facial wounds. Replacing a nasal tip or lobe of an ear and the early approximation of lip lacerations may obviate the necessity of extensive reconstruction at a later period. Lacerations involving the lip received early attention. The vermilion border was approximated carefully without tension, with the use of fine suture. A through-and-through drain was used at the lower end of the wound when there was an associated compound comminuted fracture of the jaw. Because of the rich blood supply, replaced nasal tips as well as lobes of ears very often do well, although they may have been almost completely severed for hours. If there is any indication that the severed part may reattach itself, it is well worth the time and effort to suture it in place.

In a very high percentage of cases of soft-tissue wounds of the face there is associated trauma to the bony structures. Simple fractures are comparatively uncommon, occurring as a result of accidents due to routine work or training. These fractures are identical to those seen in civilian practice.

Compound comminuted fractures.—Practically all fractures were of this type, ranging from slight loss of substance to very extensive loss of soft tissue and bony parts. There was often associated fracture of the zygoma and nasal bones and extensive damage to the paranasal sinuses and orbital walls. Basal skull fractures, although not always evident clinically or demonstrated roentgenographically, were considered present in cases of severe facial trauma.

There was always a considerable amount of shock in this type of injury. The soft tissues were edematous and hemorrhage was common. Dyspnea was often associated, causing the patient much discomfort and apprehension. The general treatment of the patient and the establishment of an airway were discussed previously.

In severe injuries it is not considered advisable to attempt fix-

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ation of jaw fragments, elevate malar bones, or attempt reduction of nasal bones until the condition of the patient has improved and is stabilized and edema has subsided. With the routine general care outlined previously, the patient as a rule showed marked improvement in from 48 to 72 hours. Early manipulation adds to the shock of the patient, excites hemorrhage, and increases the danger of meningitis.

Many of the more serious jaw fractures would have been impossible to wire early, even were it deemed advisable to do so, because of the extensive loss of substance or the damage to the floor of the mouth, tongue, palate or pharynx. The remaining fragments in these cases are splinted for the first few days by the excessive swelling and muscle spasm. It was our experience that early interference was not justified.

Simple zygomatic fractures, which were not common, were elevated by any one of the following accepted methods: (1) The Gillies method, consisting of an incision above the hairline and the temporal region down to the temporal muscle, and the insertion of a blunt instrument along the muscle and underneath the depressed arch. The fracture is elevated by outward pressure, the skull being used as a fulcrum. (2) Grasping the zygomatic bone through the skin with a towel clip. (3) Making a nick in the skin just below the normal zygomatic arch for the introduction of a curved instrument, such as a small curved hemostat, with which pressure can be directed for the elevation of a depressed fracture. (4) An incision in the buccal mucous membrane just over the second bicuspid and molar region, through which a blunt elevator may be passed underneath the depressed fracture. The third was our method of choice.

Compound comminuted fractures of the zygoma, frequently associated with fragmentation of the anterior wall of the antrum, were more often seen as a result of shell fragment or bullet wounds than simple fractures. A vertex-chin roentgenograph in addition to routine pictures, was a great aid in the diagnosis of zygomatic fractures. It was necessary to locate and remove foreign bodies before constructive work could be done. The depression of the floor of the orbit and flattening of the face is a very conspicuous deformity, which is often masked by the swelling when the patient is first seen. Diplopia is not always an associated finding. The orbital fascia acts as a hammock, maintaining the globe in its normal position. Fractures of the ramus of the mandible were often associated with zygomatic fractures. Restricted movements of the mandible were the result of the depressed fragments of the zygoma interfering with the normal excursion of the mandible by impinging on the coronoid process.

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For the restoration and maintenance of normal contour, a tight pack and drain were inserted in the antrum, following the manual manipulation of the fragments. Pieces of bone which were firmly attached to soft tissue were not removed. The pack and drain should be kept in place for 3 weeks.

Arch bars with rubber-band traction, or whatever practical appliance was necessary, were used for the reduction and fixation of fractures of the maxilla and mandible. Because of the types of fractures encountered, the operator must be prepared to devise appliances which will best suit the individual patient. It can be readily seen that no rule can be set down to govern the early treatment of all types of facial fractures encountered in war casualties. It will no doubt be necessary, in the case of many patients for whom we have made appliances, to construct new appliances or make adjustments at a later date under more ideal conditions, and when the patient's physical status has improved.

Nasal fractures were elevated and manipulated under local anesthesia. Vaseline gauze packings were inserted in both nostrils, and when necessary an external splint was applied. In cases with considerable loss of substance, nasal packing was inserted to maintain an airway, and the contour of the remaining section of the nose restored as much as possible by an external splint.

In the event of rhinorrhea, a minimum amount of manipulation was done. Both penicillin and sulfadiazine were given in all cases in which there was imminent danger of meningitis. More work than previously would have been advisable was permissible in patients having adequate intake of these two drugs. It is believed that the danger of meningitis was minimized by the use of penicillin and sulfonamides.

In conclusion, the importance of a thorough study of the patient's general condition and an evaluation of the facial trauma before repair is undertaken is emphasized. In severe facial fractures a basilar fracture should always be considered present. Early closure of facial wounds, with drainage, is believed to yield the best end results. Much time and tedious work may be required in repair of both soft tissue and skeletal structures, but the results obtained justify the effort.

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H. EYE INJURIES IN WAR CASUALTIES ABOARD A HOSPITAL SHIP

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Captain (MC) U.S.N.R.

Injury to the eyelids, globe, and adnexa were seen in approximately 8 percent of all casualties brought aboard this hospital ship in a period of 12 months. Frequently, casualties were received a few hours after injury, directly from the beachheads. In a few instances casualties had been treated by an ophthalmologist attached to a medical unit ashore. It was an exception to receive a patient aboard whose only injury involved the eye or adnexa. In most instances there were associated multiple wounds requiring prompt attention. Chest and abdominal wounds, intracranial and central nervous system injuries were often associated findings. Shock, hemorrhage, and respiratory distress were frequent emergencies.

A thorough eye examination was made as soon as possible and treatment instituted as judgment dictated. The examination of the globe in many instances was very difficult because of the great amount of edema and chemosis of the lids and surrounding tissues. Often the conjunctiva was edematous and chemotic and protruded between the swollen lids. All medical officers examined the eyes of the patients under their care and requested consultation when indicated. Much eye pathosis is missed unless some such routine procedure is carried out.

In the presence of other wounds the patient may give no indication of injuries to the eyes, and external evidence of serious eye damage may be absent. Bedside fundus, muscle, and visual field examination was therefore routine. Often, due to the patient's condition and the short time aboard, a complete ophthalmologic examination had to be left for the ophthalmologist ashore.

Many obvious eye injuries were sent directly to the eye ward by the loading officer. A careful examination of the patient on the ward often revealed other wounds not as evident but more serious to the life of the patient. Too much emphasis cannot be placed on the thorough examination of the patient and the evaluation of his wounds.

All eye casualties received roentenographic examination on admission or as soon thereafter as was practicable. Foreign bodies,

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including bullets, shell fragments, and fragments of helmet, coral, or lava were found in practically all cases, embedded in the lids, orbit, globe, or the surrounding tissues.

Almost 100 percent of all burn cases brought aboard occurred in Navy personnel. Irrigation of the eyes with normal saline solution and application of continuous wet saline dressings was routine in burns of the eyelids as soon as the patient was received on board. Penicillin drops, 2,000 units per cc., were instilled between the lids every 2 hours. Butyn and metaphen ointment was used for the relief of pain as necessary. After 24 or 48 hours some of the edema had subsided, and the crust and debris were removed more readily from between the lids and lid margins. Remaining eyelashes which were a source of irritation were trimmed. It was gratifying to note that in only approximately 2 percent of the flash burns of the lids was there any evidence of involvement of the cornea or conjunctiva. In the more favorable cases, after 72 hours boric acid ointment was substituted for the penicillin instillations and wet dressings. The corneal epithelium regenerated rapidly and in some instances was clear when the patient left the ship.

A thorough examination of the globe is indicated in all cases of laceration of the lid. Shell fragments or other foreign bodies with sufficient force to lacerate the lid had usually penetrated into the orbit or globe. When satisfied by roentgenographic examination and gentle probing that no foreign body was present in the lid or adjacent tissues, preparation for closure was made. The area was cleaned with green soap and irrigated with normal saline solution. The eyelashes and eyebrows were clipped, and conservative debridement was done. A sulfonamide was dusted into the wound and simple lacerations were approximated with fine silk sutures. When deemed necessary, a catgut suture was inserted for drainage. The lid margins were carefully brought together to prevent notching by slightly everting the point of junction. A pressure bandage was then applied over a sterile vaseline dressing and not disturbed for 3 days.

At the end of 3 days when the dressing was changed, if there was no evidence of infection the catgut drain was removed, the eye was irrigated with normal saline solution, sulfonamide powder was dusted over the line of incision, and another firm sterile dressing was applied. Sutures were removed in from 6 to 10 days. In most cases the patients were transferred before the time for the removal of sutures.

The more extensive lacerations required approximation by one of the indicated plastic procedures. In cases in which there was

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a large part of the upper lid or lower lid missing, the remaining sections were sutured together in an attempt to minimize contractures and distortion. A shield made from x-ray film was used to protect the exposed cornea. Plastic repair will be necessary in many of these cases. The main objective at this time was to preserve as much tissue as possible in the hope of aiding and shortening the definitive treatment.

Foreign bodies embedded in the conjunctiva were removed under local anesthesia. When many bodies were present it was necessary to do repeated operations. Lacerations or tears were irrigated and minute dirt particles removed or excised to prevent tattooing. The edges were then approximated with fine silk sutures. Penicillin ointment was instilled and a pressure bandage applied and not disturbed for 3 days.

In cases of nonperforating foreign bodies of the cornea, lava or coral was the most common multiple nonperforating foreign body seen. Two-percent butyn was instilled, and under the slit lamp the foreign bodies were removed a few each day with a knife needle. The pupil was dilated with 1-percent atropine and 1-percent neosynephrine hydrochloride. Penicillin solution, 2,000 units per cc., was instilled every hour and 20,000 units were given every 3 hours intramuscularly. Butyn and metaphen ointment was used as necessary for pain. Hot compresses also gave much relief. The improvement in these patients was very gratifying.

For superficial lacerations the eye was thoroughly irrigated, 2-percent butyn was instilled, and the cornea was stained with fluorescein. When the patient's condition permitted, a slit-lamp examination was done to determine the extent and depth of the laceration. If there was any indication of iritis, the pupil was kept dilated and the routine local and systemic penicillin therapy was instituted. When the laceration extended into the stroma, penicillin ointment was instilled. A firm bandage was applied over a vaseline gauze dressing which was not removed for 3 days.

Perforations at the limbus were plugged with incarcerated iris. The prolapsed iris was resected and the perforation covered by a sliding conjunctival flap. One-half-percent physostigmine salicylate was instilled, and penicillin ointment and a pressure bandage were applied over a sterile vaseline dressing. The dressing was removed in 24 hours, the eye was irrigated with penicillin solution, 2,000 units to the cubic centimeter, 2-percent atropine was instilled, and the pressure bandage reapplied. In central perforations of the cornea with no incarceration of the iris, the pupil was dilated, and a conjunctival flap was used to cover the perforation. Local and general penicillin therapy was instituted.

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Magnetic foreign bodies in the anterior chamber were removed with a hand magnet through a keratome incision. Foreign-body forceps were used on nonmagnetic foreign bodies. The anterior chamber was irrigated with a solution of penicillin, 2,000 units per cubic centimeter in normal saline solution, and a pressure bandage was applied over a sterile vaseline gauze dressing. Penicillin was used both locally and intramuscularly in all cases of perforation of the globe. Sixty grains of sulfadiazine daily was also given by mouth for the first 3 days. The pupil was kept dilated. Hot compresses, salicylates, and foreign protein therapy were used in addition to penicillin and sulfadiazine when indicated.

Often associated with perforating injuries of the globe were foreign bodies embedded in the face and neck. These were tested with the electromagnet, and less than 20 percent of them were magnetic. The Sweet localizer was used when practical. When excessive swelling was present, metal clips, inserted in the conjunctiva at 12 and 3 o'clock, 1 mm. from the limbus, were used as markers. In only two cases was a magnetic foreign body removed through the scleral incision. An attempt was made to bring the metallic foreign body forward over the ciliary body into the anterior chamber in four other cases, and in only one was it successful. Attempting to remove nonmagnetic foreign bodies from the globe in eyes that showed only moderate or no reaction to their presence did not seem justifiable. It was evident that magnetic bodies were difficult to remove when there was severe inflammatory reaction in the globe.

Small metallic foreign bodies deeply embedded in the orbital tissue were not removed. Their mere presence was no indication for their removal. Foreign bodies causing inflammatory reaction or large enough to be considered a future source of trouble were removed through incisions over the site of the fragment, those in the superior part of the orbit being reached by an incision through the brow, dissecting the periorbita from the roof of the orbit and incising meridionally. An incision over the infra-orbital ridge was used for removal of foreign bodies in the lower part of the orbit or floor. It was noted that large foreign bodies in the orbital tissues had, in most instances, shattered the globe, and the foreign body was removed at the time of enucleation or evisceration.

Injuries to the orbital wall.—It was the rule to find the skeletal structure severely comminuted. Because of the edema about the orbit and surrounding tissues, the condition of the underlying bony wall could not be determined clinically. Roentgenographs were invaluable in diagnosis and in locating embedded foreign bodies. In zygomatic fractures the infra-orbital ridge and floor

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of the orbit were depressed; unless they are elevated in the first week or 10 days, a marked deformity results which will later require extensive reconstruction. Because of the badly comminuted fragments, it was often necessary to insert a pack in the maxillary sinus to hold the orbital ridge and floor in position. There was seldom an associated diplopia, the orbital fascia giving support to the globe.

In fractures of the supra-orbital ridge, the frontal sinus was often involved. After shaving the brow and cleansing with green soap, conservative debridement of the soft tissue wound was done. Any bony fragment attached to the periosteum was not removed. If a foreign body was located by x-ray examination and was accessible, the wound was probed and the foreign body carefully removed. The bony fragments were repositioned, a rubber dam drain was sutured in place, and the soft tissues were approximated. If the frontal sinus was involved, a drain was inserted and sutured in place.

A fracture of the medial wall very often resulted in emphysema of the lids which was not detected until the swelling, resulting from the trauma, had subsided. Severe trauma to the orbital walls, especially the medial and superior walls, was considered a basilar skull fracture and a minimum of manipulation was done. The globe was ruptured or badly damaged in practically all cases of severe trauma to the orbital wall. Often large foreign bodies were lodged in the globe, in the orbit, in the paranasal sinuses, or in the anterior basilar fossa. Occasionally the globe was shattered from the explosive force of a bullet which passed through structures proximal to it.

Very few immersion blast injuries were seen. Atmospheric blast injury, however, was quite commonly seen aboard ship, owing to the preponderance of Marine and Army personnel carried. The cornea in many instances, in addition to having multiple foreign bodies, showed a wrinkling of Descemet's membrane. A number of patients had, in addition, hemorrhage in the anterior chamber. Myotics and hot compresses hastened the absorption of the blood in the anterior chamber. The cornea usually showed great improvement in 4 or 5 days.

Ophthalmoscopic examination revealed hemorrhages in the vitreous body in about 5 percent of blast cases. When the fundus could be visualized, another 5 percent of blast injuries showed choroidal tears and retinal hemorrhages. There was very little inflammatory reaction in these cases. The pupil was dilated, hot compresses were applied and symptomatic treatment was instituted. Blast concussion patients were kept as quiet as possible under

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existing conditions and restricted to bed. Intracranial hemorrhage is always a possibility in patients suffering from concussion or blast injuries. This was found in two autopsies done aboard ship.

Enucleation or evisceration was done as judgment dictated. It was often necessary to probe deep in the orbit for a large metallic foreign body following enucleation. If the foreign body was small and not too easily located, it was not thought advisable to increase the trauma to orbital tissues by unnecessary exploring. Often the extra-ocular muscles and orbital fascia were lacerated and the anatomic outline of the orbit was distorted. An attempt was made to preserve as much tissue as possible to insure a good stump for a prosthesis.

Three cases were seen which were nearly identical, each the result of a sniper bullet. The point of entrance in all three cases was the left temporal region and the exit through the right orbit. All three patients had marked intra-ocular hemorrhage in the left eye, the pupil was dilated, and there was no light perception. The right orbit and globe were shattered. In one of the three there was rhinorrhea, and x-ray examination revealed air in both lateral ventricles. The rhinorrhea ceased in 5 days and a roentgenograph at that time showed a reduction of air in the ventricles. All three patients received penicillin and sulfonamide therapy, and their general condition was improved when they were transferred. The prognosis for vision in all three cases was very poor.

On one of our last trips a patient was brought aboard who had been struck in the right eye by a snake. The right side of his face was tense, swollen, and extremely painful. He had a rapid pulse and a temperature of 104°F. on admission. There was mucopurulent discharge between the swollen lids. Continuous magnesium sulfate compresses were applied and penicillin and sulfonamide therapy was instituted. His general condition improved, and the swelling subsided in 3 days sufficiently to examine the globe. The globe was ruptured and soft, the anterior chamber was collapsed, and the cornea was opaque. An enucleation was done on the fifth day, and the postoperative course was uneventful.

Sodium pentothal was used on all cases requiring a general anesthetic. Intranasal oxygen was given throughout the course of anesthesia. Nikethamide was kept on hand for immediate use if necessary. Sodium pentothal proved very satisfactory and there were no complications.

In war casualties, irreparable damage to the globe occurred in a very high percentage of cases. Enucleation or evisceration of a shattered globe was done without delay when there was any ques-

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tion of danger of a sympathetic ophthalmia. All effort, however, was made to preserve a globe which showed no inflammatory reaction and which it was considered safe to retain.

The patients were aboard from 3 days to 2 weeks. Penicillin and sulfonamide therapy and early definitive treatment accounted for the gratifying results obtained in some of the cases which we were able to follow long enough to draw conclusions as to the end results.

I. EMBARKATION AND DISEMBARKATION OF HOSPITAL SHIP PATIENTS

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This report deals with a function in the operation of a hospital ship that may be taken for granted; namely, the embarkation and disembarkation of patients. The importance of this function really becomes evident when it is necessary to admit a large number of patients in a short time, such as this ship experienced during the campaigns in the Marianas, Palau, Iwo Jima, and Okinawa. It was only through previous organization that speedy admission of patients could be accomplished.

Every person connected with loading had to be trained to know his particular duties. The loading plan had to be simple. It was based on the principles of safety to the patient, and speed without disorder or confusion. The plan also had to be elastic enough to meet any situation that might arise. In our experience different situations arose on almost every occasion; however by making minor modifications the basic plan was adaptable to the situation. During the Palau campaign 600 patients were admitted in a little more than 4 hours.

In the operation of this plan the admitting officer, who is responsible to the senior medical officer, holds a key position. His duties are the reception, distribution and evacuation of patients. It is his duty to see that safety precautions are carried out and that the patient will suffer no further injury while being brought aboard; he does this by advising and supervising stretcher bearers. He distributes patients to the wards best adapted to care for their particular injuries, and he expedites the handling of the seriously

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wounded patients, having them promptly sent to a ward. He must anticipate any condition that may arise during a combat operation and be prepared to meet it without delay.

This ship had permanent bunk space for 409 patients, but under usual operating conditions between 500 and 600 patients were received. The additional load was cared for by cots and by adding bunks on the decks. The permanent bunk spaces were divided into wards, each ward caring for certain types of patients. There were sick officers' quarters; surgical, eye, ear, nose and throat, orthopedic, medical, genito-urinary, neuropsychiatric, and isolation wards. The additional space on the decks was used for ambulatory patients.

Prior to loading, an estimate was made as to the size of the prospective load. This depended upon the urgency of the situation and climatic conditions. No information was ever available as to the number and types of casualties. It was necessary to be prepared to meet any type of situation, and therefore certain wards were designated to care for the overflow from any given ward. Consideration was always given to wards adjoining each other; for example, if a large number of orthopedic cases were admitted, the medical wards adjoining were used to take care of the overflow, and if further space was required, the genito-urinary wards on the same deck were used for orthopedic patients.

The number of patients that a ship can transport is limited by the size of the ship and the facilities available. It is very important to know at all times the exact number of bunk spaces that can be filled and the exact location of each bunk. Before loading, a ticket, the size of a theater ticket, was prepared, one ticket representing each bunk. On each ticket was printed the ward and bunk designation. Blue tickets designated lower bunks, pink tickets upper bunks, salmon-colored tickets cots, and white tickets bunks on the deck. The tickets were carried in a box and sorted by wards.

Thus when a patient came aboard, the admitting officer would make a quick diagnosis; make a ward and bunk assignment, and give the corresponding bunk ticket to the patient. In addition to having an accurate count on available bunks at all times, stretcher bearers were advised as to the patient's ward assignment. No patient left the deck until he had been given a bunk assignment. Once a bunk assignment had been made, no patient would be transferred to another ward without first notifying the admitting officer and by making the necessary ticket exchange, or until the ship was fully loaded.

In actual loading, patients were brought aboard while the ship

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was at anchor or when another ship came alongside. At no time were docks or piers available. Patients were brought to the ship in small boats, and came aboard either over two gangways or by hoist. The first method was quicker, and more often used. The loading detail was composed of members from all divisions of ship's company, under the supervision of a chief pharmacist's mate who supervised the handling of patients and kept traffic moving.

In this detail one important group was the boat crew. It consisted of a group of husky men who would enter each boat that came alongside. They worked as a coordinated team in passing the stretcher patient from the boat to those waiting on the gangway. These men were experienced and became very adept in handling stretcher patients in all types of weather. Once the patient arrived on deck, and after his bunk assignment was made, he was interviewed by a hospital corpsman, who gathered certain pertinent information for admission purposes and for compiling a sailing list. This caused only a minimal delay in getting the patient to the ward and we found that obtaining this information on the deck was more satisfactory than after the patient reached the ward. Furthermore, as at all times the admitting officer and record office knew exactly who was on the ship and to which ward he had been sent, there was no danger of missing a patient. In the event a disturbed psychotic patient or a seriously wounded patient came aboard, a recorder accompanied the patient directly to the ward and admission procedures were carried out in the ward.

Wounded men carried very little baggage or personal effects; however a property man removed all baggage, large souvenirs, pistols, rifles, ammunition, helmets and the like, and marked them with the patient's name for storing in trunk holds. Government property which was of no further use to the patient, was returned to the beach. As rapidly as stretchers and blankets could be returned from the wards, they were sent back to the beach.

The admitting office made a diagnosis adequate for an intelligent bunk and ward assignment, as very few health records accompany patients, and usually the battle tag carries only a brief description of the wound. The answer to the question "What is your trouble?" and a brief examination was usually all that was required. Other factors often determined the bunk assignment, and the more serious injury always took precedence when several wounds existed at the same time. Eye wounds were always sent to eye, ear, nose and throat wards and disturbed psychotic patients were always taken directly to the neuropsychiatric ward.

Disembarkation.—While removing and transporting patients

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from a combat area, the purpose of the ship was to embark as many patients as possible for treatment and further transfer. This meant that due to time limitations, almost all patients were transported to a hospital in a rear area; very few returned to duty at the place of loading. This was dependent upon local policy.

As in embarkation, the discharge of patients had to be orderly. Certain procedures were carried out. Two days before the expected time of arrival, a survey was made of all patients on the ship, and they were separated according to branches of service. Each ward submitted to the record office a list of patients for each branch of service, which was further divided into: Mental, restraint; mental, restricted; mental, ambulatory; and stretcher. A message was prepared from this data and sent to the receiving activity. The record office prepared a list of all patients according to class. A tag to be attached to the left wrist was prepared, giving name, rate, diagnosis, and class for each patient.

On arrival in port, medical officers from the receiving facility would come aboard to determine the most convenient method for unloading. Usually ambulatory patients left first, followed by stretcher patients and those in the mental classification, restraint and restricted. As each patient left the ship a section of the wrist tag was removed. This was immediately checked against the list.

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ADVANTAGES OF GLOBIN INSULIN

Globin insulin is as good or better than protamine zinc insulin in the moderately severe diabetic, requiring one large dose of protamine zinc insulin for proper regulation. It may be of advantage in those cases exhibiting allergic reaction to protamine and in those subject to nocturnal hypoglycemia. Globin insulin did not show such uniformly good results in the more severe diabetics in whom separate injections of protamine and regular insulin are necessary. However it is worth a trial in such patients, in the attempt to eliminate extra injections of insulin. Six of ten patients required less globin than protamine for satisfactory diabetic control. The other four cases were regulated with the same dose of both types of insulin. Of 6 patients stabilized with protamine and regular insulin, only 2 were able to secure similar regulation with globin insulin alone.—TRASOFF, A.; BORDEN, C.; and MINTZ, S. S.: Globin insulin: clinical study. Am. J. Digest. Dis. 12: 313-315, September 1945.

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PNEUMOROENTGENARTHROGRAPHY AS A DIAGNOSTIC AID IN INTERNAL DERANGEMENTS OF THE KNEE

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and
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The injection of air into the knee joint as a contrast medium for the roentgenographic visualization of intra-articular structures is not a new procedure. Controversy, however, over its value as a diagnostic adjunct is still open among orthopedists and roentgenologists.

Realizing the limitations of air as a contrast medium, but also further recognizing that up to the present there is not a superior substitute, the authors proceeded to develop a technic of air injection and stereoscopic x-ray views of injured knees for the purpose of aiding in the differential diagnosis of internal derangements of the knee joint.

A series of 50 patients have been injected during the period from 1 June 1943 to 1 June 1944. Of these, 24 have been operated upon, with verification of the x-ray diagnosis in 18, thus establishing a 75-percent rate of diagnostic accuracy.

Diagnostic problems in and around the knee joint are usually divided into two main classes, external and internal derangements. External derangements of the knee joint include pre- and parapatellar bursitis, Osgood-Schlatter disease, rupture of the quadriceps tendon, fracture of the patella, hypertrophy of the retropatellar fat pad, Pellegrini-Stieda disease, strain of the internal or external lateral ligaments, popliteal space cyst, and tear or rupture of the capsular ligament.

Patellar fracture, Pellegrini-Stieda disease, and Osgood-Schlatter disease may be diagnosed by the usual flat roentgenograms. The other conditions may be diagnosed without the use of air injection, except hypertrophy of the retropatellar fat pad. In this condition air injection and air arthroroentgenograms are helpful.

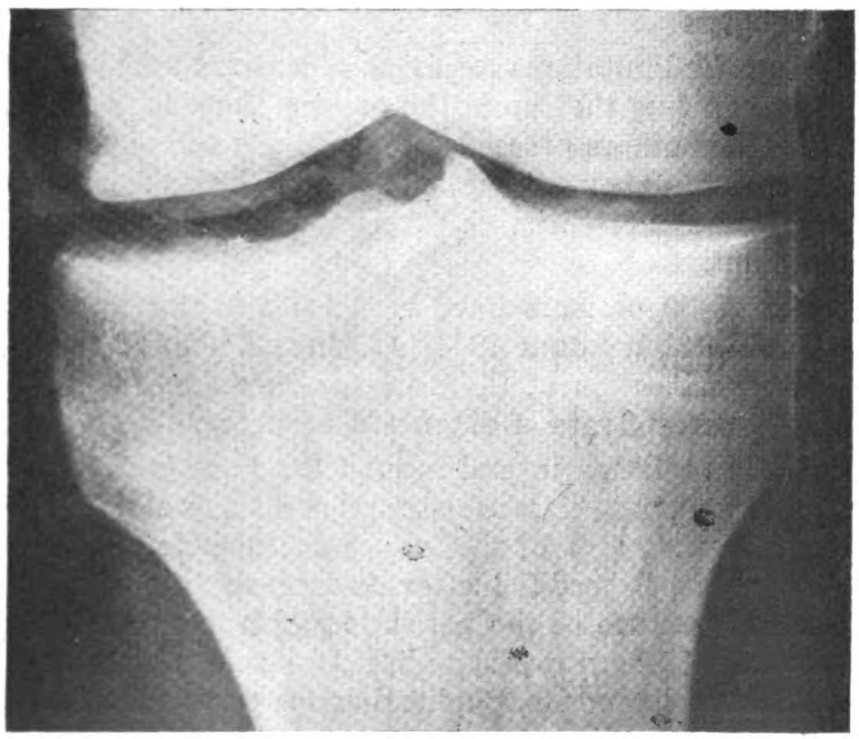
The internal derangements comprise hypertrophic synovitis, tear or rupture of synovial membrane or of the cruciate ligaments, injury to the semilunar cartilages, fracture of the tibial

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spines or intra-articular fracture of the tibial plateau, and osteochondritis dissecans. Traumatic synovitis and hemarthrosis, which may be primary or arise as complications of any of the aforementioned conditions, also are included.

Flat roentgenograms are of value in the diagnosis of tibial and tibial spine fracture, and of most cases of osteochondritis dissecans. Injuries to the semilunar cartilages have been successfully diagnosed in this manner by many orthopedists and roentgenologists.

The authors believe, however, that the use of air as a contrast medium for x-ray visualization has a definite and positive value in the diagnosis of injuries to the semilunar cartilages, in hypertrophic synovitis, in hypertrophy of the retropatellar fat pad, and in the establishment of a differential diagnosis in cases of persistent or recurrent synovitis or hemarthrosis.



1. Redundancy and hypertrophy of the synovial membrane in the intra-articular space is readily observed in this case.

Procedure.—Of the patients operated, 6 had symptoms less than a month, whereas in the remaining, symptoms had existed from 5 to 15 years. The patients' ages ranged from 18 to 49 years, with an average age of 30 years. All cases were associated with a history of an injury to the involved knee at some time in the past

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and generally with an aggravation of the old injury prior to the patient's admission to the hospital. After taking a history of the injury, flat x-ray films in the anteroposterior and lateral views are taken. If after this procedure the diagnosis is still in doubt, air is injected into the knee joint and x-ray stereograms made.

Patients with traumatic synovitis or hemarthrosis were injected only after a conservative treatment had failed to prevent recurrence, and when it was believed that the cause of recurrence was an internal derangement which had not been determined.

Three cases are cited as illustrations of the type in which the air arthroroentgenogram should have a definite diagnostic value.

CASE REPORTS

Case 1.—A 34-year-old fireman, first class, was admitted to the hospital with an injury of the right knee sustained while jumping a hurdle. The patient stated he jumped the hurdle with his right knee in right-angle flexion and landed on his right foot with his knee still in flexion. This caused a snap and pain in his right knee, sufficiently severe to make him fall. He further maintained that he had injured the same knee while playing football 12 years before and had had intermittent bouts of pain in the knee for a number of years, but he had been symptom free until the present time.

On physical examination the right knee joint was found to contain a small amount of fluid. There was definitely localizable tenderness over the medial aspect of the joint immediately over the cartilaginous attachment. Extension was of full range. Flexion was limited by 10 degrees. There was no abnormal anteroposterior or lateral mobility. There was moderate quadriceps atrophy, the circumference of the right thigh being 1 inch less than the left.

The fluid was aspirated from the joint cavity and a pneumoarthroroentgenogram made. This was rather inconclusive as it did not rule out a possible derangement of the medial cartilage. The patient was treated conservatively with daily quadriceps exercises for 2 months without return of joint fluid and with improvement in his quadriceps. However he maintained that he felt something continually catching in his joint and was fearful of the joint locking.

Arthrotomy was done and a markedly hypertrophied synovium was found, with intact cartilages and cruciate ligaments. The retropatellar fat pad, however, could not have impinged between the joint surfaces.

In retrospect a review of the roentgenograms in this case gives a fairly good x-ray picture of the redundant synovium found at operation. It is believed that had we had more experience in dealing with knee injuries and with the interpretation of aeroroentgenograms at this time, operation would not have been attempted.

Case 2.—A 30-year-old fireman, first class, was admitted following an injury to his right knee sustained by twisting his knee while stepping off a concrete form. There was no history of previous injury.

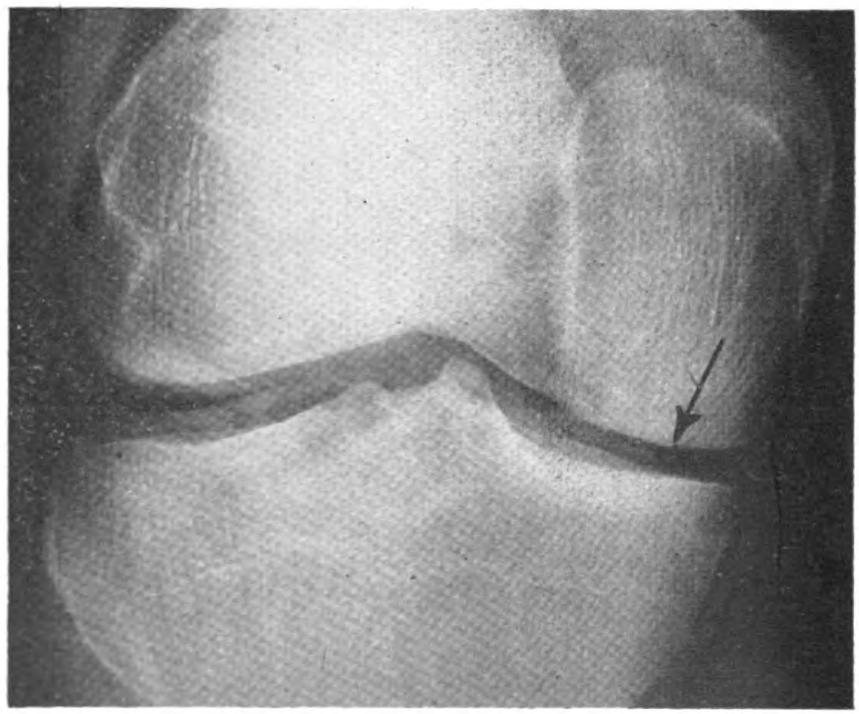
The chief complaint was of pain in the medial aspect of the knee joint, which was greatly aggravated on motion.

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Physical findings were essentially negative except for slight swelling and tenderness localized over the medial aspect of the joint. The knee was bandaged with a layer of thick cotton, and an elastic bandage was applied.

The day following admission a mass could be palpated in the popliteal space. This mass increased in size so that after several days it became about 3 cm. in diameter. One week after admission a cyst resembling a ganglion was removed from beneath the tendon of the medial head of the gastrocnemius muscle. There was no communication between the cyst and the joint cavity. Convalescence was uneventful and the patient was out of bed on the fourth postoperative day.

On the second day out of bed the patient was observed to have a moderate amount of intra-articular fluid. This fluid was aspirated and found to be clear synovial fluid. The knee was rebandaged and the patient returned to bed with quadriceps exercises for about 10 days, at which time an arthroroentgenogram was made. This revealed a longitudinally split medial cartilage with the medial portion displaced medially and posteriorly. At operation a longitudinal split through the cartilage, with the medial portion displaced to the center of the joint, was found. A medial menisectomy was performed.



2. A break in the continuity of the medial articular cartilage may be observed at the point marked with an arrow.

This case is being reported because it is believed that in view of the existence of the popliteal space cyst, an arthroroentgenogram taken at the outset would have been of definite value as a diagnostic procedure not only as to the presence of intra-articular injury but also to show whether or not the popliteal space cyst communicated with the joint cavity.

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Case 3.—A 31-year-old carpenter's mate, third class, was admitted with a history of a knee injury sustained while wrestling 3 weeks previously. The patient stated that the injury resulted from an outward twist of the knee.

On admission there was obviously fluid within the knee joint. Aspiration revealed a hemarthrosis. This recurred on three occasions over a period of several weeks. Arthroroentgenograms were made without a definite diagnosis.

Operation revealed a markedly thickened and reddened synovium with a posterior tear. A postoperative review of the x-ray films did not shed any light on the preoperative x-ray interpretation.

Aspiration technic.—Preparation is done on the x-ray table, observing the same general aseptic technic as that followed for simple aspiration of the joint. After local skin and subcutaneous anesthesia, a 1½- or 2-inch 20- or 22-gage needle is introduced into the joint, the route lateral to the patellar ligament being used unless greater damage is suspected in the lateral cartilage, when the medial approach is employed. Landmark reference to routine knee films was found useful in facilitating entrance within the capsule. However with the knee flexed between 20 and 30 degrees a soft spot may be palpated in the interarticular space either medial or lateral to the lower portion of the patella almost on a level with the patellar tendon. A needle may be inserted at this point and directed upward and medialward or lateralward toward the intercondylar notch, depending on whether the needle is introduced on the medial or lateral aspect of the patella, so that ready access is had to the joint cavity with a minimum possibility of encountering joint surfaces with the sharp needle point.

A 20-cc. syringe with a small sterile cotton filter at its needle outlet is used. Little resistance to the plunger is noted when the needle is within the joint, unless fluid is encountered, in which case this is aspirated as completely as possible.

COMMENT

In our cases the amount of air necessary to separate properly the tissues and fill the joint space varied considerably, depending upon the size and habitus of the patient, intercommunication and size of the bursae, presence of small amounts of fluid, and other factors.

Roughly from 60 to 150 cc. was necessary. The most reliable signs for determining satisfactory inflation were palpation and noting the back pressure raising the plunger of the syringe. This is the usual point at which the patient complains of slight pain. If the pressure seems insufficient after removal of the needle, an elastic bandage around the thigh above the knee will express the air out of the suprapatella bursa into the joint.

X-ray factors are determined in the same manner as for routine knee roentgenograms according to the thickness of the part. A

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40-inch distance (tube film) with vertical (long axis of knee) tube shift of 2½ inches for the stereo films was employed, making one lateral and both anteroposterior (dorso, ventral) and postero-anterior stereo projections, with the rays paralleling the tibial articular surface. With careful positioning, 5- by 7-inch films are used in par speed casettes. Results with the Potter-Bucky diaphragm were somewhat more satisfactory than when using a non-grid technic.

Both sets of stereo films may be set up together for viewing without changing adjustment of the stereoscope. There were indefinite conclusions and unsatisfactory visualization in several cases due to improper technic, such as too little air within the joint, the presence of fluid, or extravasation of air into the overlying soft tissues. Good results, however, were usually obtained after allowing about a week's interval and repeating the procedure.

Complications.—Among the complications the following are listed: 1. Air embolism has to be considered and guarded against. None of the patients in the present series have shown any of the signs or symptoms suggestive of air embolism. This condition may be avoided by adhering to a rigid technic and by being sure at all times that the needle point has not entered a blood vessel. If it is found that the needle has entered a vessel, no air should be injected, and the procedure should be discontinued. Localized pressure should then be continuously applied at the site at which the needle point has entered the vein.

2. Infection may be guarded against and should be avoided by adhering to a strictly aseptic technic in all cases and by never instituting this procedure on a knee acutely inflamed.

3. Possible injury to the articular synovium or cartilage. This should be mentioned merely in passing, as with gentleness in inserting the needle and directing the point toward the intercondylar notch, no damage should be done.

CONCLUSIONS

1. The procedure of injecting air into the joint has a definite value as a diagnostic adjunct in those cases of injury to nonradiopaque structures within the knee joint, as is evidenced by 75-percent diagnostic rate accuracy in 25 operated cases.

2. Cases in which this procedure is of value as an aid in diagnosis should be carefully selected. Only patients with suspected injury or damage to nonradiopaque structure within the knee joint, on which a clinical diagnosis cannot positively be made, should come within the scope of this procedure and the procedure should never be carried out on an acutely inflamed joint.

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EFFECT OF BITE-WING ROENTGENOGRAMS ON NAVY DENTAL EXAMINATION FINDINGS

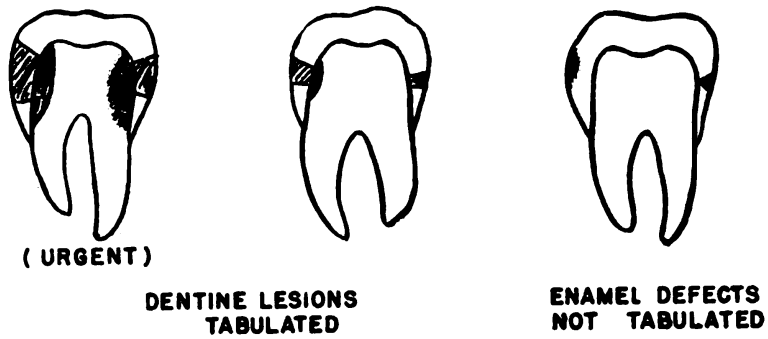
JAMES M. DUNNING
Lieutenant Commander (DC) U.S.N.R.
and
GEORGE W. FERGUSON
Lieutenant Commander (DC) U.S.N.

A previous study on this station (*1*) has demonstrated that the midshipmen at the U. S. Naval Reserve Midshipmen's School, New York, when compared with other available groups, show an average cumulative dental caries experience, but a very low incidence of tooth loss. This study was based on quick explorer examinations and was therefore roughly comparable to studies of other examinations similarly made. It was designed to give the dental life experience of the group in terms of teeth decayed, missing, or filled, and particularly to evaluate the efficiency of past dental treatment within the group in terms of the control of tooth loss. Only secondarily was the study designed to give current needs for dental treatment, as the conditions under which examinations were made rendered them probably inaccurate in the listing of early lesions of caries, especially proximal lesions.

In order to measure the efficacy of explorer examination technic and to study means of improving the examinations, midshipmen from several entire sections chosen at random from the nineteenth and twentieth classes, a total of 100 men, were given careful reexamination by explorer supplemented by one pair each of posterior bite-wing roentgenograms. Tallies were made of the total number of caries in each mouth and of the posterior proximal lesions in each mouth (distal of the cuspid and posteriorly) at the following times: (1) At the time of the latest previous dental examination found in the midshipmen's health records (some of these examinations had been made at V-12 training stations, and some on arrival at this station); (2) at the time of the test explorer examination found in the midshipmen's health records (some of genograms alone; and (4) after a combination of roentgenographic and explorer findings, followed by recheck at the chair when deemed necessary.

The average time between the previous examinations and the

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1. Diagrammatic representation of proximal lesions as evidenced in roentgenogram, tabulated and not tabulated.

test examinations proved to be 10½ months for the group as a whole. In tabulating data from the roentgenograms, enamel defects (as shown in the accompanying illustration) were not tabulated, but any radiolucency was noted which indicated a cavity penetrating to the dentine. Radiolucencies which involved significant areas of the dentine itself and suggested the possibility of early pulp involvement were not only tabulated but marked "urgent."

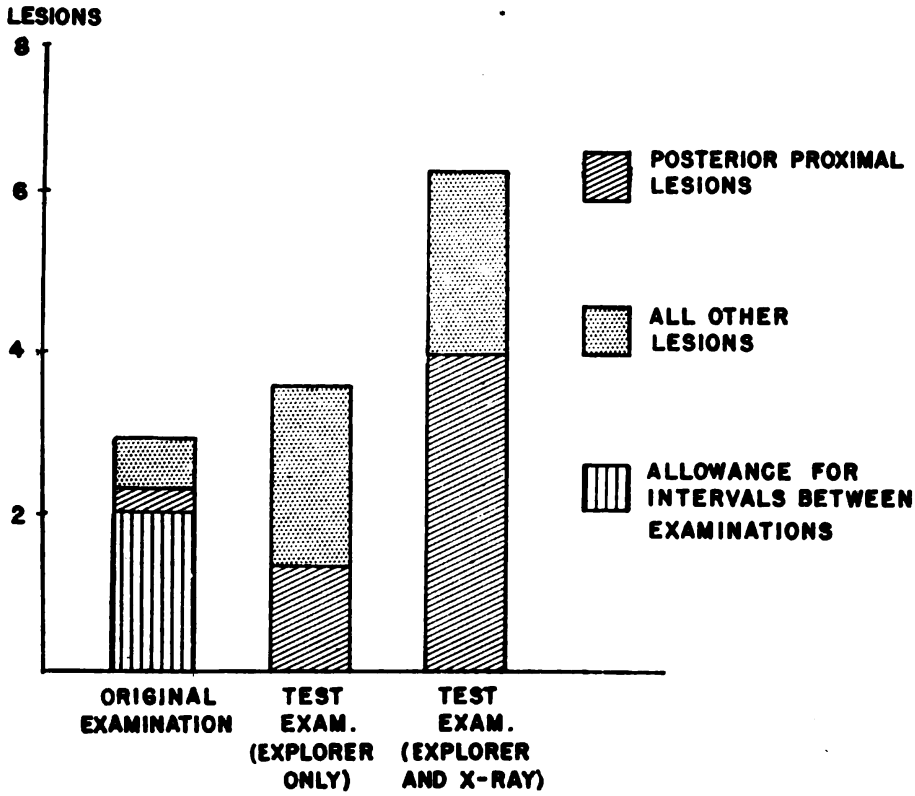
The accompanying graph shows the result of the tabulation of findings. The midshipmen's original examinations, corrected to remove lesions subsequently treated, gave a total of one lesion per person, of which 0.3 were posterior proximal lesions. Two additional lesions per person were added to the column in which these examinations were tabulated, to represent as nearly as possible the expected new caries lesions within the period between the original examination and the test examination. No exact figures for this increment could be obtained, since most caries studies are done in terms of either teeth or surfaces rather than lesions, but data from examinations of draftees as reported by Klein (*2*) and from figures from the Metropolitan Life Insurance Company (*3*) gave grounds for assuming a rate of approximately two lesions per year for men 21 or 22 years of age.

The test examination by explorer alone gave an average of 3.6 lesions per person; 1.3 of these were posterior proximal lesions.

The roentgenograms, considered by themselves, showed 3.4 posterior proximal lesions per person. No attempt was made to tabulate caries lesions other than proximal from these pictures. The combination of the test explorer findings and the roentgenographic findings gave 6.4 lesions per person, of which 4.0 were posterior proximal.

In the entire mouth the use of two bite-wing films increased findings of dental caries by 78 percent over the findings by explorer alone. Considering the posterior proximal areas separately,

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2. Lesions of dental caries found per case among 100 unselected midshipmen from U.S.N.R. Midshipmen's School, New York City.

the bite-wing examination yielded an increase of 215 percent, or 315 cavities found by bite-wing plus explorer examination where only 100 would be found by explorer alone. A fairly large number of enamel defects were also seen in the bite-wing films, but were not tabulated because of the lack of urgency of such cases, because of the fact that some of the lesions might be arrested, and finally, because of the feeling of many dental operators that defects as small as these, not confirmable by explorer, do not warrant operative intervention.

With a view to evaluating those cavities needing immediate attention in order to avoid pulp disease and loss of teeth in the near future, the "urgent" posterior proximal lesions were separately tabulated as stated. Ninety-eight such lesions were found, or almost exactly one per person. Of these 98, thirty-nine were found by explorer first and the other 59 by roentgenographic examination alone. This finding radically altered our previous concept as to the ability of the explorer to detect deep caries lesions, and leads to the conclusion that the use of roentgenograms is warranted, even when operative dentistry of only the most urgent nature can be undertaken.

This increase in diagnosis of caries as the result of employing

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bite-wing roentgenograms is corroborated by a study made of cadets at the U. S. Coast Guard Academy, New London, Connecticut, by Arnold, Dean, and Singleton (*4*). One hundred eighty-eight cadets of a mean age of 19.5 years were examined clinically and then with a set of 4 posterior and 3 anterior bite-wing films. These films added 3.6 new surfaces or areas to the caries experience of this group upon one occasion, and 3.3 surfaces or areas upon another occasion. Further corroboration of the value of the bite-wing method is found in unpublished data from the Metropolitan Insurance Company in 1939 (*5*) in which 100 cases were tabulated in a manner almost exactly similar to the present study. In these cases an increase of 26 percent was registered for the mouth as a whole, and an increase of 64 percent in the posterior proximal region alone. The smaller increase in this instance may possibly be due to the fact that explorer examination was performed with at least two explorers and immediately following dental prophylaxis. The pressure of time, also, was almost undoubtedly less.

The value of bite-wing roentgenograms in detecting lesions urgently in need of treatment is brought out strongly by White (*6*) in a study of 800 aviation cadets. One pair of posterior bite-wing films revealed 4.4 lesions per cadet, of which 1.4 extended half the distance or more from the dento-enamel junction to the pulp and "required immediate attention." The number of posterior proximal lesions found by explorer is not stated, but the inference is made that this number was small.

As a matter of interest and to test the validity of the previous study (*1*), the total number of decayed, missing, or filled teeth per person (DMF teeth) was tabulated both at the time of the original dental examination and at the time of the final combination of bite-wing and test explorer findings. The original DMF total was 11 and the final DMF total was thirteen. This small increase of only 18 percent gives reason for believing that studies made from explorer examinations are not seriously inaccurate when used to show life caries experience in terms of decayed, missing, or filled teeth. It is not only possible, but frequently the case, that additional proximal lesions will appear on a tooth already bearing an occlusal filling. These proximal lesions are important from the standpoint of treatment, but do not alter the DMF count for the patient's mouth in any way, as the tooth is already listed as filled.

SUMMARY AND CONCLUSIONS

A series of test examinations on 100 unselected midshipmen from the U. S. Naval Reserve Midshipmen's School, New York City, showed 3.6 caries per person by explorer alone and 6.4 by a

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combination of explorer method and two posterior bite-wing roentgenograms. The bite-wing films gave an increase of 78 percent over the explorer method alone for the mouth as a whole, with an increase of 215 percent in the posterior proximal region. One proximal lesion per person appeared to approach the pulp closely enough to require immediate attention. Of the total of 98 such "urgent" lesions found, only 39 were recognized by explorer alone. Other studies by different authors corroborate not only the substantial increase in diagnosis of proximal lesions when bite-wing roentgenograms are taken, but also the fact that many, if not a majority, of lesions endangering the pulp will remain unnoticed if such roentgenographic examination is not made.

These findings lead to the suggestion that dental roentgenographic examination to the extent of one pair of bite-wing films be made on every man entering the United States Navy, whether in commissioned or enlisted status, at some stage in his induction or training. It is also suggested that men now in service receive such an examination as soon as may be conveniently possible, except in cases (usually among older men) where all posterior proximal tooth surfaces have been filled or lost.

The findings from each pair of roentgenograms should be entered on the record of first dental examination on Form H-4, and under *Remarks* a symbol such as "BWXR" or a rubber stamp legend such as "Posterior bite-wing roentgenograms taken and findings recorded, date ....." should be made.

When necessary treatment cannot be completed at the station where the roentgenograms were taken, arrangements should be made to staple the films, with or without an envelope to contain them, directly to the man's health record jacket. This procedure will aid dental officers at subsequent stations.

If doubt is felt as to the wisdom of routine roentgenographic procedures for large groups of Naval personnel at a time of film shortage, it should be remembered that only 4 square inches of film are required per patient and that many dental needs can be met by the use of salvaged medical film as suggested by White.

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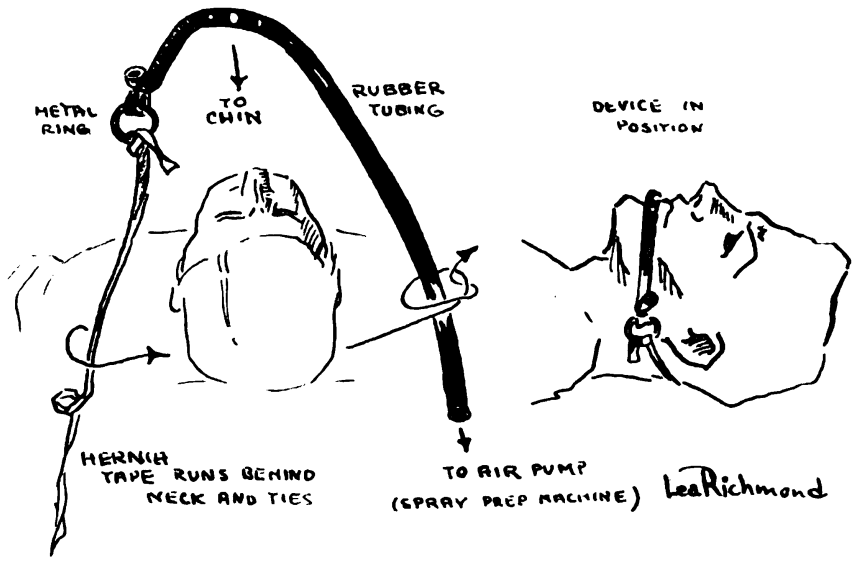
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METHOD OF SUPPLYING ADEQUATE AIR TO PATIENTS DRAPED FOR EYE OPERATIONS

Effective draping for eye operations necessarily embarrasses the air supply to the patient, and frequently more of the operative field than is desirable must be exposed in order to provide for comfortable breathing. The problem has been met in the following manner.



Perforated rubber tubing, ½-inch in diameter, is fastened across the patient's chin. One end of the tubing is sealed; the open end is connected to the air stream from the air pump. The perforations are placed over the chin and directed upward toward the nose. The closed end of the tube is fitted with a metal ring. A strip of hernia tape extends from this ring, around the back of the neck, and is tied loosely to the opposite arm of the tubing. The patient is then draped for operation in the usual manner. The force of the air current may be regulated from the machine. This device has been given an extensive clinical trial, and has proved itself a source of satisfaction to both patient and operator.—RICHMOND, L., V-12, U.S.N.(H), and FRIEDMAN, B., Commander (MC) U.S.N.R.

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SEVENTY-EIGHT HUNDRED SCARLET FEVER PATIENTS

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The contagious section of the McIntire Unit, U. S. Naval Hospital, Great Lakes, Ill., and nearby dispensaries, received 7,836 cases of scarlet fever from 1 January to 1 June 1945. The patients originated largely among recruits and service schools in the immediate vicinity and in Chicago.

In previous winters it has been common to have a moderate incidence of streptococcal disease. Such was the situation in the season of 1944-45 until the second week in January when the intake rose sharply and persisted high until summer. There was a coincident increase in pharyngitis without rash and in sinusitis and otitis media. The epidemiologic unit of the Naval Training Center identified the common organisms as Group A streptococci—Types 17, 3, and 19.

It is of interest that these types were prevalent in an outbreak at the Farragut, Ida., station in the late winter of 1943-44. The possible relationship of the local outbreak to that in the Northwest is under study by the epidemiologic unit. At the time of the sharp increase in the incidence of streptococcal disease most barracks personnel in the area were on a standard sulfadiazine prophylaxis program. The sulfa-resistant character of the streptococci was further demonstrated by laboratory methods under the direction of the National Naval Medical Center.

All patients on admission were placed on the usual treatment measures for acute infectious and toxic diseases. Those who were quite "toxic," those with a fever over from 101.5° to 102° F., and those with a membranous sore throat and those with any complication or extension such as otitis, cervical adenitis, or pneumonitis were given penicillin intramuscularly. The usual dose was 20,000 units followed by 10,000 units every 3 hours until fever free. Any patient with a hemoglobin under 80 percent who was quite ill was given a transfusion of convalescent citrated blood (500 cc.).

Convalescent serum was produced in adequate quantities by the latter part of February to make it available for most patients on admission. It was subsequently given intravenously in 50-cc. doses on the admission of all but those with very mild infections. Unfortunately for the purposes of statistical analysis the time of

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the greatest use of the convalescent serum was coincident with an apparent decrease in the virulence of the organism.

A review of 1,000 patients discharged in the last 3 weeks of March showed that 66 percent of patients who were started on routine ward measures because of the apparent mildness of the infection had fever after the fifth day. Those who were judged to be moderately or severely ill and who were therefore started early on penicillin had no more frequent elevation of temperature after the fifth day than the milder group. Forty-one percent of those receiving convalescent serum on admission had temperature elevation after the fifth day, and of those who were severely affected and who received both penicillin and convalescent serum on admission, 44 percent had fever after the fifth day.

Five patients died of complications. One of these, not subjected to autopsy, appeared to have died of edema of the glottis. Three had pneumonia. One died quite unexpectedly on the twenty-first day, having been symptom free for 5 days, with postmortem findings of toxic myocarditis and hepatitis.

Most complications responded to several days of penicillin therapy. In February, when the average census of scarlet fever patients was about 1,700, the wards contained patients with complications in the following approximate incidence:

	Percent
Otitis media	9
Pneumonitis	2
Rheumatic symptoms	2

On June 6, with a census of 208, the incidence was as follows:

	Percent
Otitis media	3.8
Rheumatic symptoms	3.3
Pneumonitis	0.5

Throughout the season only 2 patients developed persistent nephritis. Sinusitis and mild cervical adenitis were quite common. Orbital cellulitis occasionally was associated with sinusitis. Pharyngeal or retropharyngeal abscess was not uncommon. Two patients developed edema of the glottis despite penicillin but recovered following tracheotomy.

While probably less than 2 percent of patients in the scarlet fever, pharyngitis, and otitis wards developed symptoms of rheumatic fever during the period of quarantine or hospitalization for their acute illness, approximately 1,000 were at one time or another on the sick list because of that disease. The ultimate incidence would therefore appear to be about 10 percent.

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The use of large amounts (250 cc.) of serum later in the course of the disease for the treatment of complications developing from the fifth to the fifteenth day seemed without definite effect. Several patients with presumed subacute streptococcic infection, shown by a persistent daily fever of 99.5° F., two to three weeks after admission, appeared benefited by 250 cc. of convalescent serum.

The treatment of choice in all complications was penicillin. It seemed apparent that whereas sulfadiazine was quite ineffective (it was tried occasionally), penicillin given early and in continued dosage was effective. It was believed that penicillin should be continued from 3 to 5 days after the patient became fever free. Although over 6,000 intramuscular injections a day were being given by hospital corpsmen, no local infections occurred.

CONCLUSIONS

1. Much useful information can be kept at hand by epidemiologic year-round sampling of prevalent strains as to type and susceptibility to therapeutic agents.

2. The regular collection of convalescent serum from patients with streptococcal diseases is most desirable. Typing of the patient's infecting strain might not be too large a problem in view of the apparent effectiveness of convalescent serum and of the desirability of employing type-specific sera. In a large outbreak the pooling of sera can be expected to provide type-specific antibodies.

3. The possibility of a sulfa- and penicillin-resistant strain developing must be borne in mind. The development of additional chemotherapeutic aids is highly desirable.

4. Control of factors of epidemiologic importance, such as barracks dust and ventilation and the sterilization of air in enclosed places, is desirable. Further knowledge of the climatic relationship to the incidence of disease, and the depression of individual immunity by inoculation and other early training routines and of adequate criteria for the quarantine not only of scarlet fever but of other streptoccal respiratory infections, must be sought.

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STREPTOMYCIN IN CLINICAL TUBERCULOSIS

Streptomycin is an antibiotic substance developed in the laboratory of Dr. S. A. Waksman and his associates and first described in January 1944. Among the organisms found susceptible to its action in vitro is the bacillus of tuberculosis. Its therapeutic effect on tuberculous guinea pigs was striking. Since that time

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streptomycin has been utilized at the Mayo Clinic in the treatment of 34 patients who had tuberculosis, all with unfavorable prognosis. While it is too early to draw any definite conclusions from this preliminary study of a small series of cases, findings of the progress report do point to the clinical possibilities of this substance.

These investigators preferred the intramuscular route of administration, but the subcutaneous route was used when less irritating preparations of the antibiotic were obtainable. Purity of the substance largely controlled reactions, but rarely were serious reactions encountered, even when the substance was used for several weeks without interruption, with injections at least every 4 hours.

Sixteen patients with pulmonary tuberculosis were treated for a period of from 1 to 3 months. Streptomycin did not appear to have any rapidly effective curative action in these cases, but extensive and progressive lesions of known recent origin tended to improve promptly. Two patients with early miliary tuberculosis and one with renal tuberculosis showed striking x-ray but no clinical evidence of improvement. Six patients with cutaneous tuberculosis showed striking improvement.

While the reproduction of Mycobacterium tuberculosis may have been temporarily inhibited by the treatment administered, there was no convincing evidence of rapidly effective bactericidal action. Preliminary impressions, however, point to the probability that streptomycin exerts a limited suppressive effect, especially on some of the more unusual types of pulmonary and extrapulmonary tuberculosis. These results, however, merely indicate that there is a great deal more to be learned about the drug, and a more extensive study is underway. Especially is study needed on the early and extensive hematogenous forms of pulmonary tuberculosis, tuberculosis of the genito-urinary tract, suppurative tuberculous lymphadenitis, and early miliary tuberculosis.

It is cautioned that as long as streptomycin remains difficult to procure and the toxic effects of protracted treatment remain in doubt, it would appear inadvisable to utilize it in treatment of some of the commoner forms of chronic pulmonary tuberculosis in which the patients are not likely to derive striking benefit. The investigators emphasize that care in a sanatorium and collapse therapy, being proved effective therapeutic measures, in no instance should be abandoned in favor of treatment with antibacterial agents, such as streptomycin, the range of efficacy of which is yet to be conclusively demonstrated. Morale, they point out, is a most important factor in treatment of such a debilitating and chronic disease, and morale is injured by premature and optimistic reports of results which may not be sustained in practice. No one as yet actually knows what the final judgment will be concerning the effect of streptomycin on clinical tuberculosis.—HINSHAW, H. C., and FELDMAN, W. H.: Streptomycin in treatment of clinical tuberculosis; preliminary report. Proc. Staff Meet., Mayo Clin. 20: 313-318, September 5, 1945.

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CONVALESCENT SERUM AND POOLED PLASMA IN COMMUNICABLE DISEASES

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Human convalescent serum has been shown to be of value in the prophylaxis and treatment of scarlet fever, measles, and mumps.

In a previous article (*1*) it was pointed out that pooled human plasma may possess the same therapeutic properties as convalescent serum, since most of the plasma in use by the armed forces is obtained from donors who live in urban areas and have had, or have been exposed to, the common cummunicable diseases.

Antibodies to specific diseases are known to be present many years after recovery. Wolf and Levinson (*2*) state that serum obtained from the average urban adult contains an appreciable amount of antibodies to certain diseases. Their figures show that 4 cc. of normal serum or plasma is approximately equal to 1 cc. of scarlet fever convalescent serum in the treatment of scarlet fever. Karelitz and Levin (*3*) found essentially the same ratio in regard to measles convalescent serum.

Convalescent serum is obtained by collecting blood from persons recently recovered from the specific disease and is prepared by methods standardized by the National Institute of Health. The blood is drawn from donors who have had the disease within the past 6 months. However, much of the blood used is taken at or near the termination of the illness, while the patient is still hospitalized. The serum is pooled so that each batch represents at least 10 donors. This serum can be kept in the liquid form and preserved for from 12 to 18 months at 4° to 6° centigrade. Better still, it can be dried from the frozen state and kept for an indefinite period at room temperature, so that a sufficient amount will always be on hand for epidemics.

Scarlet fever and other streptococcal infections.—Since the advent of chemotherapy, we have been prone to overlook other forms of therapy for infections caused by the streptococcus. Certain strains of Streptococcus pyogenes have appeared which are sulfonamide resistant. Strains may also appear that are penicillin resistant. Before the use of either sulfanilamide or penicillin, scarlet fever convalescent serum had been used with extremely favorable results. Hoyne and his associates (*4*) reported a series of 1,430

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cases of scarlet fever treated with convalescent serum in adequate dosage, and found that it produced a prompt recession of fever, toxemia, angina, and fading of the rash. They also believe that the number of complications was greatly reduced, and no unfavorable reaction, such as serum sickness or anaphylactic shock, was encountered.

Bahov (*5*) reviewed 1,000 cases and stated that convalescent serum is the ideal form of therapy. Prinzing (*6*) reported that the use of convalescent scarlet fever serum reduced the incidence of complications. Platou (*7*) believed that convalescent scarlet fever serum, administered to a patient who seems incapable of efficient antibody production, quickly combats toxemia and inhibits bacterial invasion.

The mode of action of serum has been a matter of conjecture. Scarlet fever convalescent serum has been titrated by Top and Young (*8*) who found that their specimens averaged about 2 units of antitoxin per cubic centimeter. Moore and Thalhimer (*9*) found the antitoxin content of their serum varied from 1 to 10 units per cubic centimeter, the average being 3.3 units per cubic centimeter. The average dose of commercial scarlet fever antiserum prepared by the Dick method contains 6,000 units of antitoxin. Since the average dose of convalescent serum for an adult, depending on the severity of the case, is from 20 to 120 cc., administered intravenously, it is obvious that its specific value in reducing toxicity, fever, and rash is not dependent on the antitoxin content alone. Top and Young believe that its beneficial effect is due to the presence of antibacterial substances, augmented slightly by the small amount of antitoxin found in this type of serum.

Thalhimer and Levinson (*10*) have further demonstrated a broader application of convalescent serum. Excellent results were obtained by using scarlet fever convalescent serum in the treatment of such conditions as septic sore throat, cervical adenitis, and otitis media, caused by Streptococcus pyogenes. Hiatt and Goldberg (*11*) reported its beneficial use in Streptococcus pyogenes infections complicating a severe burn.

Measles.—Measles convalescent serum has been shown to be of distinct value in the prophylaxis of this disease and attenuation of the virus. Its therapeutic benefit seems limited to the pre-eruptive stage. Levinson and Connor (*12*) stated that the intravenous administration of 50 cc. or more of convalescent measles serum will produce modification of the disease after the catarrhal symptoms have started. Thalhimer (*13*) believed that serum may be of value in the treatment of measles and encouraged its use.

Dungal (*14*) reported beneficial results from convalescent serum

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after using it in an epidemic of measles in Iceland, in patients with catarrhal symptoms already present. Kohn and his associates (*15*) stated that the intravenous injection of from 40 to 50 cc. of convalescent serum given intravenously in the pre-eruptive stage modified the course of the disease in most cases; the use of from 40 to 105 cc. of serum in the eruptive stage had little effect on the course, unless given at the very beginning of the eruption.

Many of the complications of measles, mainly otitis media, sinusitis, and adenitis, may well respond to the general antibacterial properties in normal human serum or pooled plasma.

Mumps.—Observations made here on the use and therapeutic value of plasma in the treatment of mumps orchitis confirm those recently reported by Smith (*16*). Results were excellent and dramatic. To add to the previously reported information on this subject, Hinckley (*17*) treated by convalescent serum 23 patients with early mumps, and found that the disease lasted a shorter time, and that there were fewer bilateral and complicated cases.

CONCLUSIONS

Because pooled plasma can be expected to be only one-fourth as potent as convalescent serum, a correspondingly larger dose will be necessary. Levinson and Wolf advise that at least 250 cc. of normal serum or plasma be given as a therapeutic dose. Naval hospitals with blood banks, and shore stations near metropolitan areas where convalescent serum is available, may well use these facilities. Medical departments at sea or at foreign bases can substitute pooled plasma for convalescent serum by using a correspondingly larger therapeutic dose. The use of convalescent serum has been well established in the treatment of scarlet fever. It is believed that convalescent mumps serum and pooled plasma should be used further in the treatment of mumps orchitis.

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SURGICAL TREATMENT OF HETEROPHORIA

Two hundred eleven operations were performed upon 135 patients for the correction of heterophoria. Most recent examinations of this group, varying from 4 weeks to 15 months after operation, show that of the 66 cases of exophoria, 55 obtained satisfactory results. Eleven failed to achieve this goal. Of the 51 cases of esophoria, 47 were enabled to meet the physical standard requirements, while 4 failed to do so. Of the 18 cases of hyperphoria, 15 succeeded in meeting qualifying standards and 3 failed to do so. Later examination undoubtedly will show a higher percentage whose muscle imbalance will change for the worse as time goes on as illustrated by the one case cited where exophoria of 8 p.d., corrected to 2 p.d. following recession of both lateral rectus muscles, had increased to exophoria of 10 p.d. 10 months after the last operation. Efforts will be continued to obtain later records on as many as possible of this group in order to determine how lasting may be the effects of surgical correction.—TOWNES, C. D.: Surgical treatment of heterophoria. Tr. Am. Acad. Ophth. 49: 338-343, July-August 1945.

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PENICILLIN IN INTRAPLEURAL INFECTION[1]

JOSEPH JACOBSON
Commander (MC) U.S.N.R.

Attention has been called to the rapidly increasing cellular content and specific gravity of the pleural fluid following local use of penicillin.[2] The necessity has also been noted for aspiration at progressively higher levels because the dependent portion of the empyema cavity became occupied by semisolid organized exudation.

The methods of treatment may be divided into four groups:

1. Thoracotomy.
2. Penicillin intrapleurally followed by thoracotomy.
3. Penicillin intrapleurally and intercostal drainage.
4. Penicillin intrapleurally.

1. *Thoracotomy.*—There is nothing to add to this well-standardized method of treatment. Both open and closed drainage following generous rib resection were used on this service. The most seriously ill patient in this group is presented for comparison.

This 23-year-old white male was admitted 26 January 1944. He was desperately ill, toxic, dyspneic, and cyanotic. He had been ill for 1 month (fig. 1A). Repeated taps revealed heavy, creamy pus with negative bacteriologic findings until a diagnosis of pneumococcus empyema was finally established. Intercostal drainage with azochloramid irrigations was started but this type of drainage was inadequate and thoracotomy was performed. Comparatively rapid progress followed, though a fairly extensive pneumothorax was present (fig. 1B). Final examination reveals very moderate thickening of the pleura (fig. 1C).

2. *Penicillin intrapleurally followed by thorcotomy.*

Case A. Pneumococcus empyema.—This patient was admitted 29 December 1943. Chest aspirations were performed over a period of 12 days with instillations of 50,000 units of penicillin; 200,000 units in all (fig. 2A). On 11 January 1944 a thoracotomy was done, with azochloramid irrigations every 3 hours; recovery followed with moderate thickening of the pleura over the lower medial lung field (fig. 2B).

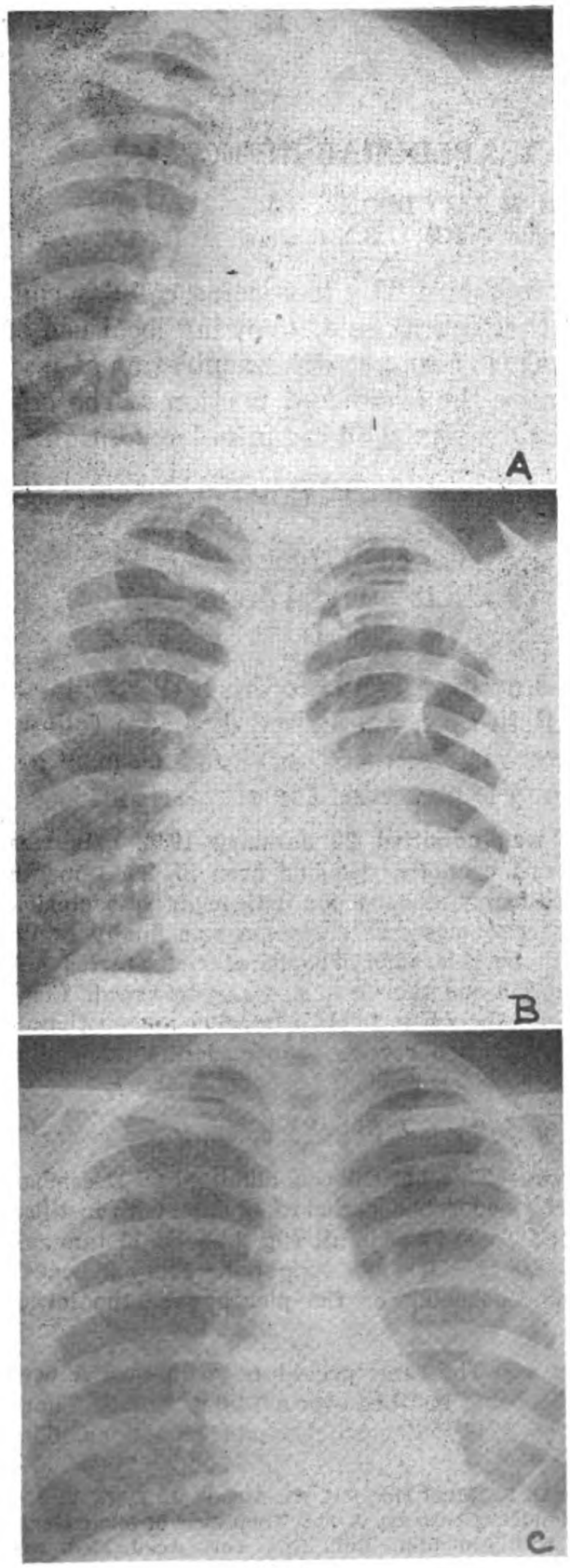
Case B. Pneumococcus empyema.—The same procedure as in case A was followed, 250,000 units of penicillin being instilled over a 14-day period. Thoracotomy was performed 9 January 1944, with azochloramid irrigations. The

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[1] From the Surgical Service of the U. S. Naval Hospital, St. Albans, L. I., N. Y.

[2] TILLETT, W. S.; CAMBIER, M. J.; and MCCORMACK, J. E.: Treatment of lobar pneumonia and pneumococcal empyema with penicillin. Bull. New York Acad. Med. 20: 142-178, March 1944.

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A. Condition preceding thoracotomy. Empyema cavity was filled with heavy, creamy pus.

B. Condition following thoracotomy, showing decided improvement, although an extensive pneumothorax is present.

C. Final roentgenogram shows only moderate thickening of pleura.

Figure 1.

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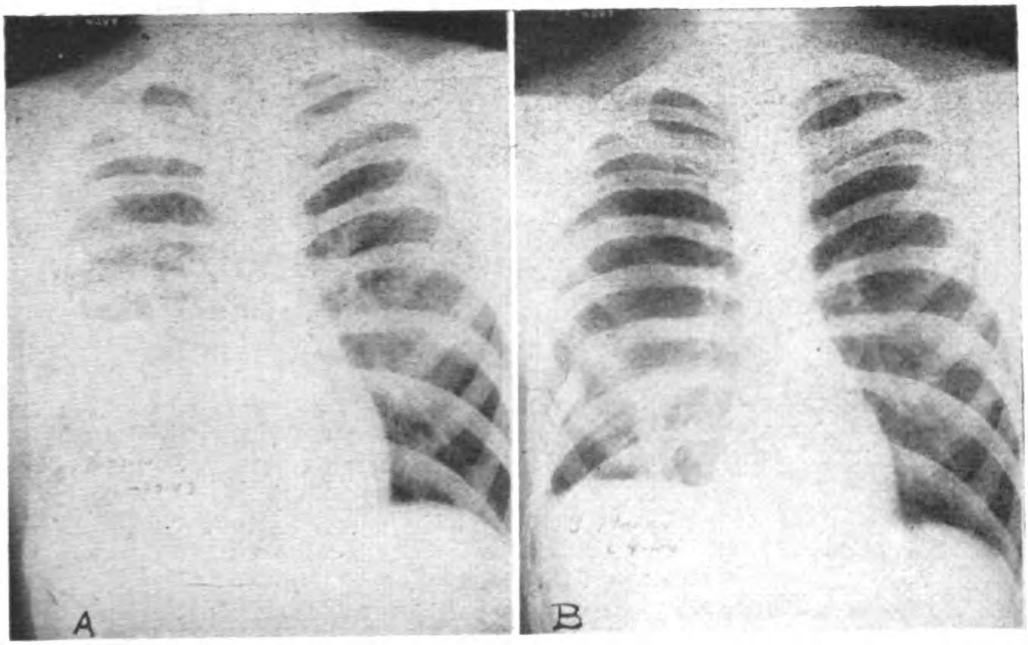


Figure 2.

end result was moderate pleural thickening, high retraction of the diaphragm, and some atelectasis of the lower left lobe.

Case C. Pneumococcus empyema.—A similar method of treatment was used as in cases A and B. One hundred seventy-five thousand units of penicillin were instilled over an 8-day period. A thoracotomy on 1 February 1944 was followed by azochloramid irrigations. Recovery followed with considerable pleural thickening over the entire lung field.

3. *Penicillin intrapleurally and intercostal drainage.*—These patients had simple intercostal tubes inserted and azochloramid irrigations every 3 hours from 0900 to 1800. At 2100, 50,000 units of penicillin were introduced through the tube, which was clamped until 0900 the following day.

Case A. Pneumococcus empyema.—On 18 February 1944 an intercostal catheter was inserted and the above procedure followed for 15 days. The intercostal catheter was withdrawn when the cavity was obliterated. A period of 2½ months was necessary to obliterate this empyema cavity. The end result showed considerable pleural thickening.

Case B. Streptococcus empyema.—This patient was a desperately ill hospital corpsman, age 20 years. Repeated aspirations were done from 3 January to 17 January 1944 (fig. 3A). An intercostal catheter was inserted 26 January and the procedure as outlined was followed. In all 900,000 units of penicillin were instilled over an 18-day period. Two and one-half months were required to obliterate this cavity and the final result reveals considerable impairment; the affected side is narrowed and there is pleural thickening (fig. 3B).

4. *Penicillin intrapleurally.*—These patients had no surgical intervention other than aspiration plus instillation of penicillin.

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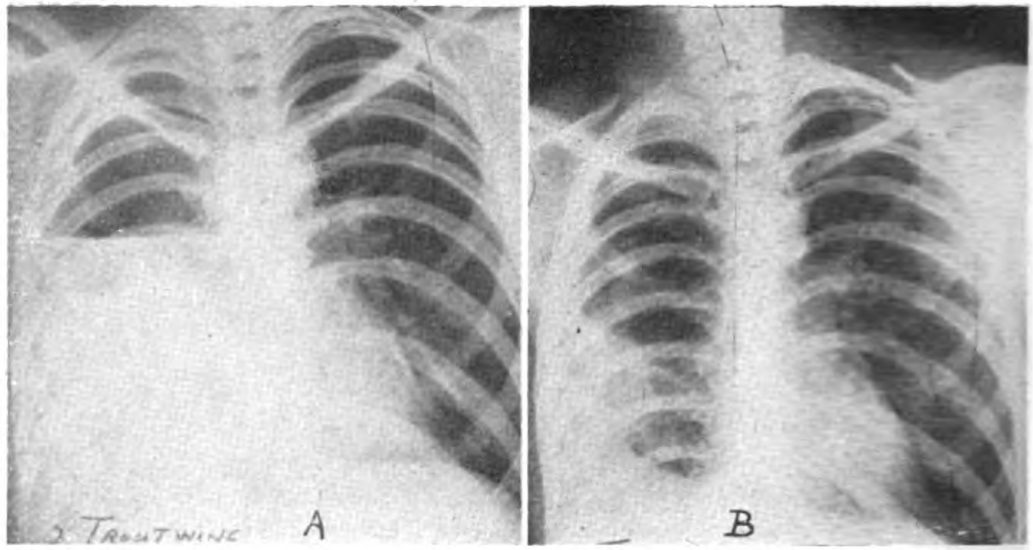


Figure 3.

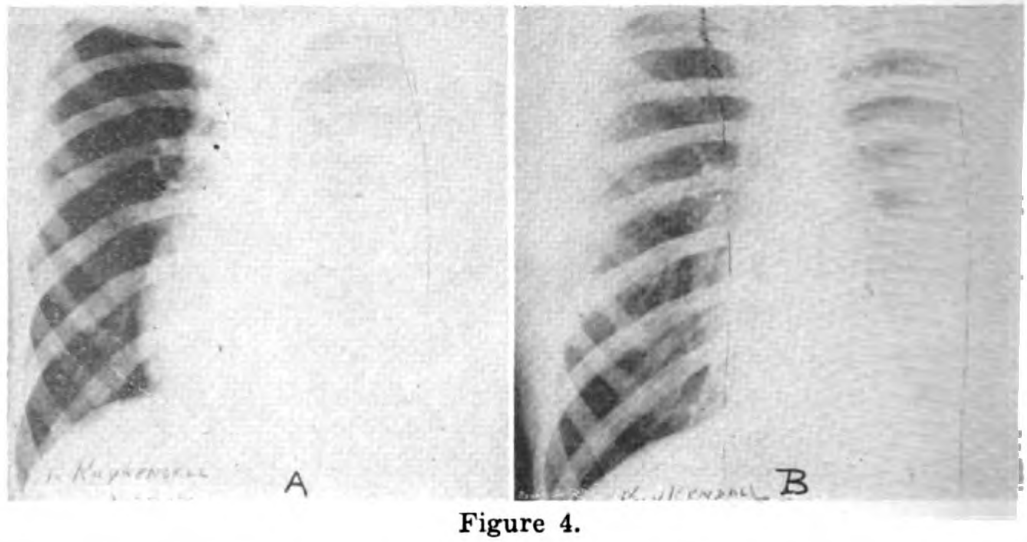


Figure 4.

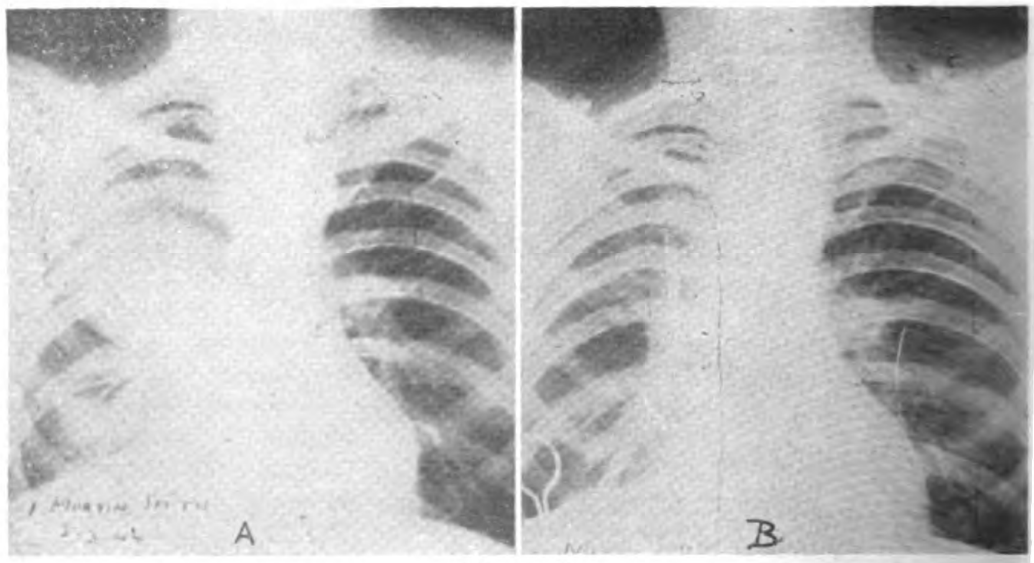


Figure 5.

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Case A. A positive diagnosis was not made on this patient. He had received adequate dosages of sulfadiazine, and negative bacteriologic findings following chemotherapy are fairly common. When admitted, aspiration revealed a slightly cloudy fluid which was negative for organisms on direct smear and culture. Aspirations with penicillin instillations were carried out every 4 days for 12 days, 200,000 units of penicillin in all. In approximately 2 months there was practically complete clearing.

Case B. Streptococcus empyema (fig. 4A).—Procedure as outlined above was followed. Following aspiration, 50,000 units of penicillin were instilled every fourth day; 300,000 units in all. Four weeks later aspiration yielded 100 cc. of a heavy purulent fluid which was negative on slide and culture. Fourteen weeks after treatment was started, repeated aspiration yielded no fluid. The end result reveals tremendous pleural thickening (fig. 4B).

Case C. We were so impressed by the productive reaction caused by penicillin locally that we attempted to obliterate a chronic empyema cavity by its use. Six months previous to admission this patient had been treated for an empyema by thoracotomy. His convalescence was slow and there remained a draining sinus posteriorly in the right ninth interspace. On frequent occasions during the following few months he had a high temperature and pain in the chest, followed by a profuse discharge from this sinus. His admission x-ray film (fig. 5A) revealed a large, round, dense shadow above his original empyema cavity. A catheter was introduced with difficulty through his sinus and lipiodol was instilled. Fifty thousand units of penicillin, 5,000 units per cc., were introduced through the catheter daily. Gradually less penicillin could be used (fig. 5B) and the catheter was removed when only 1 cc. could be introduced. The cavity was entirely obliterated by proliferative process in 5 weeks.

Empyema thoracis 1943 to 1944

	Number of cases	Average no. of days for recovery*	Mortality
1. Thoracotomy	8	44	0
2. Penicillin intrapleurally followed by thoracotomy	3	63	0
3. Penicillin and intercostal drainage	3	75	0
4. Penicillin intrapleurally	4	100 plus	0

* Criteria for recovery were: Normal temperature, pulse, respiration, leukocyte count, sedimentation rate, and complete obliteration of empyema cavity.

This is in no way to be construed as an attempt to discredit the marvelous and dramatic therapeutic effect of penicillin. (The systemic use in preventing complications is accepted and recommended.) Rather it is an attempt to evaluate the local use in intrapleural infection. Definite conclusions from this superficial work might be premature and dangerous but in a rapidly changing world of therapeutics, where the tendency in severe infections is swinging toward the use of penicillin first and the determination of the etiologic factors and diagnosis second, it might be well to think of the possible deleterious effects in the local use of penicillin. No

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attempt has been made to ascertain whether this deleterious effect is due to the penicillin itself, to impurities in the penicillin, or to the dilution used.

CONCLUSIONS

1. The over-all recovery time in empyema thoracis is prolonged by the use of penicillin intrapleurally.

2. The initial response is good but the subsequent constitutional recovery is slow.

3. Marked thickening of the pleura may follow, with resulting chest deformity and impairment of pulmonary physiology.

4. The cavity can be sterilized by use of penicillin intrapleurally but it may leave a heavy fluid collection which will not be absorbed.

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OTITIS EXTERNA ACUTE

At this activity 60 cases of acute otitis externa were treated daily with penicillin and glycerin wicks, 500 units of penicillin per cc. of glycerin. The cases included in this series were those with secondary infection resulting in cellulitis, characterized by pain, redness, swelling and edema, purulent discharge, and maceration. The following are conclusions reached from this series.

1. Penicillin in glycerin will not result in a cure in all cases. Five of these cases required admission to the ward with additional therapy of local heat, analgesics, and sulfadiazine orally or penicillin intramuscularly. Penicillin intramuscularly was used in 3 of these cases with excellent results. In addition to penicillin in glycerin, 4 patients were given sulfadiazine orally at onset because of severity of symptoms.

2. Relief occurred gradually over a period of 24 hours in the majority of cases, and not immediately or dramatically. This relief was gradual and progressive in the majority of cases.

3. Unless the condition was relieved within 3 or 4 days, it was necessary to change to some form of therapy for subacute or chronic otitis externa. Failure to change resulted usually in a stationary condition and occasionally in an exacerbation.

4. In no case was there suppuration, or necessity for drainage.

5. In severe otitis externa, the use of penicillin in glycerin will result in relief, and will obviate admission to the ward in a larger percentage of cases than with any other routine of local treatment.—WELLS, J. L., Commander (MC) U.S.N.

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CLINICAL NOTES

DERMOID CYST OF RECTOVAGINAL SEPTUM

REPORT OF A CASE

H. L. PUGH
Captain (MC) U.S.N.
and
AUSEY H. ROBNETT
Lieutenant (MC) U.S.N.

While dermoid cysts of the ovary are relatively common, dermoid tumors of the pelvic connective tissue are rare. That they do occur as definitely recognized entities in the pelvic structures is, however, well known. They give rise to symptoms related to their position, size, and intrusion of the mass on the pelvic organs. The most common sites in the pelvis for dermoid tumors are, according to Frank (*1*), first, the paraproctium between the rectum and sacrum, second, the base of the broad ligament, and third, the retrocervical tissues below the cul-de-sac of Douglas and the round ligaments. Although frequent reports of adenomyosis and endometriosis of the rectovaginal septum are to be found in the literature, cases of dermoid or retention cysts of the rectovaginal septum have been reported infrequently. The Quarterly Cumulative Index Medicus covering the last quarter of a century contains only two references, those of Maizels (*2*) and Rossi (*3*). Frank, however, quotes Freund as having mentioned 33 cases, and in 1925 Dussuel (4) published a thesis on these cysts.

The origin of a dermoid cyst of the rectovaginal septum is largely a matter of conjecture. Ewing believes that dermoid cysts of the pelvic connective tissue probably result from the misplacement of portions of the ectoderm associated with the development of the proctodeal membrane, neurenteric canal, or cloacal membrane. Other authors have mentioned the wolffian body (Karsner), embryonal rests which are abundant in pelvic tissues (Curtis), and migrating blastomeres sequestrated from such embryonic structures as the müllerian ducts (*5*) (*6*).

Dermoid cysts have a characteristic appearance; soft, greasy, granular sebaceous glands are contained in a tough, epithelium-lined wall. Hair is often found as a part of the cyst content. On roentgenographic examination these cysts may be suspected when

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an ovoid mass of diminished density with a banded, mottled appearance, surrounded by a capsular ring, is found in the pelvic tissues.

A case is presented in which the mass was determined at the time of surgery to be a dermoid tumor of the rectovaginal septum with, in addition to its highly unusual location, an unusual association with a cyst of the pseudomucinous type which Novak has mentioned as occurring in conjunction with dermoid cysts. The cyst was enclosed within a pseudomucinous cyst located in the rectovaginal septum and encroaching upon both the rectum and vagina.

Case report.—This 24-year-old Navy nurse entered the hospital with the sole complaints of constipation and low back pain gradually increasing during the 6 months prior to admission. The past history, menstrual history, and inventory of systems yielded only negative findings.

The patient was well-nourished and well-developed. On vaginal and rectal examination, a rather large, soft, mildly tender cystic mass was palpated posterior and to the left of the rectum, apparently lying in the ischiorectal fossa and not attached to the rectal mucosa, but encroaching on the lumen of the rectum from the left, posteriorly, beginning almost 1 inch from the anal outlet and extending uniformly about 3½ inches proximally.

Radiographic examination by barium enema showed a narrowing of the lower rectum and displacement of this portion of the rectum to the right by a retrorectal mass approximately 9 cm. in diameter.

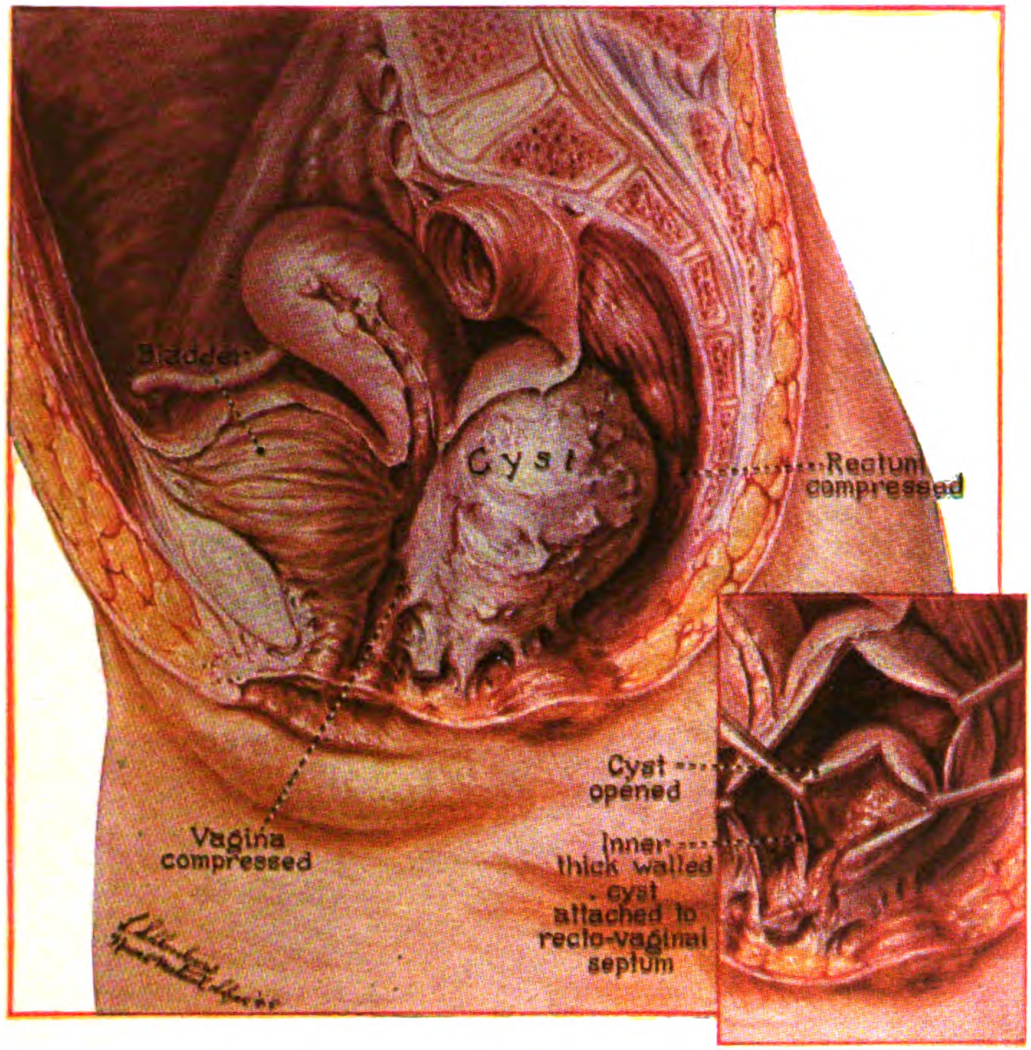
Surgical removal of the mass was accomplished through a midline suprapubic incision. Deep in the pelvic structures a well defined cyst the size of a large orange was encountered. A line of cleavage was developed and this cyst was mobilized and separated from the surrounding structures down to the wall of the rectum, where it could not be separated further without grave danger of entering the rectum, the vagina, or both. It was therefore opened and approximately 200 cc. of mucoid, white viscid fluid removed. Within this cyst, and attached immediately to the rectovaginal septum, there was a thick-walled inner cyst. This was opened and an ounce or more of heavy caseous material, such as is commonly found in a dermoid or sebaceous cyst, was evacuated. As much of the cyst wall was excised as could be done without grave danger of entering the lumen of the rectum or cutting through the vaginal wall. The abdomen was closed with steel wire, No. 32, and skin clips.

The patient's postoperative course was completely uneventful and she was discharged from the hospital 2 weeks after operation.

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Saggital section of pelvis showing position and anatomic relationship of dermoid cyst in the rectovaginal septum.

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POISONOUS SNAKE (HABU) BITES

REPORT OF EIGHT CASES

DUANE G. SONNEBORN
Lieutenant (MC) U.S.N.R.

During the Okinawa campaign the number of cases of snake bite encountered was not only much smaller than expected but also the bites were decidedly less toxic than was anticipated. In the 3 months of this operation, of a total of some 6,500 admissions to the sick list at the Third Corps Medical Battalion of the Third Amphibious Corps, only 8 cases of snake bite were treated. The snake inflicting the bite was in all instances the *habu* (Trimeresurus mucrosquamatus), supposedly one of the most poisonous of all the Okinawan snakes.

CASE REPORTS

Case 1.—The most striking case was that of a 20-year-old Marine private, an infantryman. At 0100 of the day he was bitten, while lying in a bush at the side of a tomb peering on two Japs below, he felt on his cheek what he thought was a twig poking him. He turned around to see what the difficulty was, and was again struck on the cheek below the left eye. He then saw the snake and shot it. His cheek began to swell immediately and within 5 minutes his left eye was swollen shut. In about an hour his entire face was swollen, including his right eye, and the swelling had begun to extend down his neck. His throat became sore when he swallowed but up to the time of his admission to the hospital at 1000, he had had no difficulty in breathing.

The patient had no systemic symptoms such as headache, vomiting, or diarrhea. Enroute to the hospital, he had received morphine sulfate, ½ grain, about 2 hours after being bitten, also 500 cc. of whole blood, and 1,000 cc. of saline solution intravenously, and sodium bicarbonate, 2 gm. every 4 hours orally. (The rationale of the latter measure is not clear to the writer.)

The patient had received no antivenom prior to his admission, nor had the site of the bite been incised. The site of the bite had become anesthetic soon after the patient was bitten.

On admission, the patient's temperature was 98.4° F., the blood pressure 120/80, and the pulse rate 82 beats per minute. He was responsive but his speech was thickened, due to facial, lip, and tongue swelling. His eyes were swollen shut. He could barely open his right eye, and was unable to open the left. There was a brawny, nonpitting, slightly tender edema involving the entire face and scalp and extending behind both ears down into the neck. The left buccal mucosa was swollen, the right appeared normal. The nasal airways were open, the tongue slightly swollen. There was no apparent obstruction to the upper airways. There were no abnormal findings in the chest, heart, or abdomen. Neurologic examination revealed no abnormality of re-

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flexes. There was an area of anesthesia about 2 cm. in diameter at the site of the bite.

A blood count showed a hemoglobin concentration of 72 percent, 3,240,000 erythrocytes, and 8,000 leukocytes with 87 percent polymorphonuclear leukocytes.

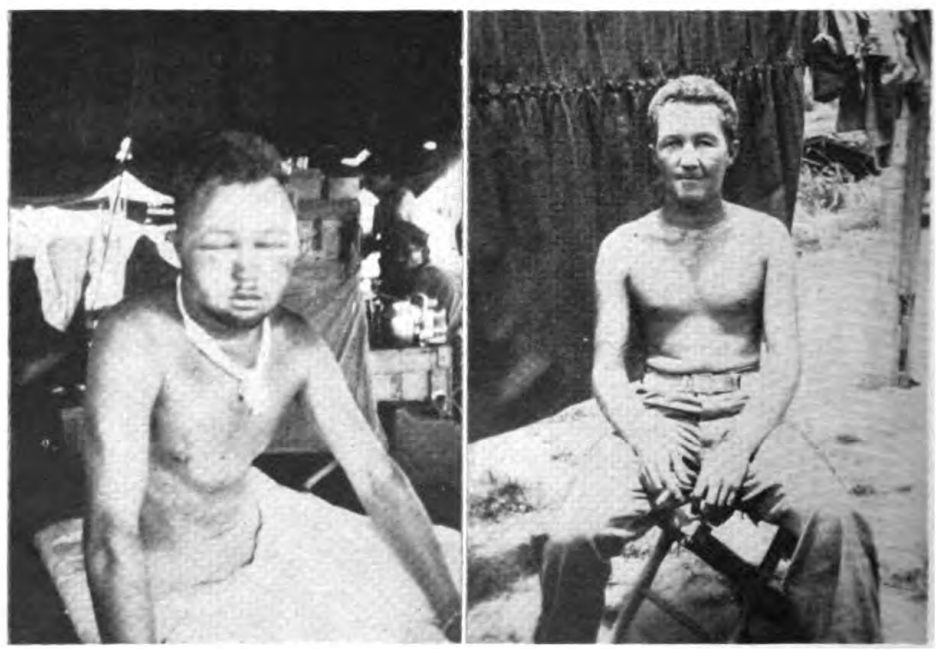
Ten cubic centimeters of Brazilian antivenom (1 unit) was administered intramuscularly at 1030; fluids were given intravenously because of the patient's inability to swallow, and cold compresses were applied to the face and neck.

By 1900 the edema had spread downward to involve the right shoulder and the upper portion of the chest anteriorly. The patient was also beginning to have some difficulty with respiration due to soft tissue swelling. A tracheotomy set was kept available, but it never became necessary to use it.

Thirty-two hours after receiving the bite, the brawny edema had spread down the anterior portion of the chest to the xyphoid process. The swelling was most prominent on the right side. However the patient was breathing more freely and some of the tongue and buccal mucosal swelling had subsided. He had begun to cough up a yellowish, mucopurulent sputum, probably from the region of the nasopharynx. Penicillin therapy was started as a prophylactic measure against secondary infection.

Two days after receiving the bite, the patient was able to eat a little food, and breathing was unobstructed. The tissue swelling had stopped at the lower rib margin anteriorly. The skin over the cheeks, brow, and eyelids had developed an ecchymotic appearance similar to that seen in a bad bruise. The skin over the chest showed early ecchymotic changes. The patient's blood pressure was maintained at its original level and his pulse rate varied between 70 and 80 beats per minute.

Three days after admission, the discoloration of the skin over the eyes and cheeks had become bluish black, that over the neck and anterior chest wall



Case 1. (Left) Twenty-four hours after bite. (Right) Two weeks after receiving the bite.

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more purplish. The white blood cell count had now fallen to 4,600, with a normal differential count.

On the fourth day following admission, the patient developed hives over his entire body. This was thought to be an allergic reaction to the antivenom and it responded readily to epinephrine.

Six days after being bitten, the patient could open both eyes, and the chest swelling had almost completely subsided. Eleven days after admission all swelling had subsided with the exception of a slight residuum over the left cheek and the lids of the left eye. The pupil was in partial mydriasis and there was a partial internal paraplegia. It was the opinion of the ophthalmologist that this was probably a remnant of venom effect and that no treatment was indicated.

Two weeks after being admitted, the patient was returned to duty with only a slight residual swelling of the left upper eyelid and left cheek.

Case 2.—A second case of snake bite of the face was also seen, in which the bite was inflicted on the forehead. This patient received Brazilian antivenom within an hour of the bite. He also had a brawny edema of the face, scalp and neck, but never had the prominent swelling of the eyelids noted in the first case cited. Within 8 days all swelling had completely subsided. This second patient did exhibit a few systemic symptoms, having been bothered with nausea and vomiting during the first 24 hours.

Two cases in which the site of the bite was the wrist offered an interesting parallel. One man received no antivenom until 10 hours after being bitten. He had a moderate brawny edema of the arm up to, but not including the shoulder, but not a single systemic symptom. In the second case antivenom was administered within 2 hours of the time he was bitten, and the site of the bite was also incised. The patient's arm was greatly swollen, the edema being brawny in type, and involving the shoulder, with extension down the lateral wall of the chest. This was accompanied by repeated vomiting during the first 24 hours.

The sites of the bites in the remaining four cases seen were the ankle, fingers, wrist, and buttocks. In the last-named case the patient received antivenom, the others did not. All of these cases were characterized by prominent local and regional swelling of the tissues but few systemic symptoms.

Two of the four patients receiving antivenom developed hives 4 and 8 days, respectively, after receiving it.

The question of the efficacy of the antivenom arises. It was known before this campaign that the Brazilian antivenom was not specific for the venom of the *habu,* but inasmuch as no specific antivenom was available, it was deemed advisable to use it until such time as specific antivenom could be developed from captured snakes. It is granted that such a small number of cases affords no true index of the value of the Brazilian antivenom; however it is the writer's opinion that those who received the antivenom late, or not at all, recovered as well as those who received it early.

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One thing is certain; the bite of the *habu* is not nearly as deadly as it was reported to be. There was no fatality due to *habu* bite in the Tenth Army on Okinawa. Okinawan doctors told us that only the very young or very debilitated ever died of this condition.

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BERIBERI HEART DISEASE

That thiamine deficiency (American beriberi) is not a rigid syndrome nor a rare one, is concurred in by Cincinnati's Marion A. Blankenhorn. The following diagnostic criteria are suggested:

1. Enlarged heart with normal (sino-auricular) rhythm.
2. Dependent edema.
3. Elevated venous pressure.
4. Peripheral neuritis or pellagra.
5. Nonspecific changes in the electrocardiogram.
6. No other cause evident.
7. Gross deficiency of diet for 3 months or more.
8. Improvement and reduction of heart size after specific treatment.
9. Autopsy findings consistent with beriberi.

Beriberi heart disease may be found as a complication of other forms of heart disease.—BLANKENHORN, M. A.: Diagnosis of beriberi heart disease. Ann. Int. Med. 23: 398-404, September 1945.

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PERSISTENT HEPATITIS

Lingering hepatitis is a frequently encountered cause for disability of patients seen in a debarkation hospital. They are convalescents from attacks of acute hepatitis suffered overseas and, as a rule, no longer reveal jaundice, but show subjective clinical symptoms similar to those noted in the prodromal state, without objective or laboratory manifestations of hepatic disease. They appear susceptible to exacerbation following dietary, exertional, or alcoholic excess. Because of the possibilities of acute, possibly fatal, exacerbations and chronic liver damage, it is recommended that a complete evaluation of these patients be undertaken before a return to unrestricted activity is permitted. The active mobilization of these patients should be deferred until convalescence is well established, and then undertaken under proper precautions. The only etiologic factor elicited (and that in only about one-sixth of the cases) was an antecedent trauma, with associated administration of blood products.—FISHMAN, A. P.: Persistent hepatitis in patients returning from overseas. Bull. U. S. Army M. Dept. 4: 457-462, October 1945.

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ACUTE APPENDICITIS IN AMEBIC DYSENTERY

REPORT OF A CASE

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Captain (MC) U.S.N.
and
R. STARR LAMPSON
Commander (MC) U.S.N.R.

Acute appendicitis in amebic dysentery is a condition seldom encountered by surgeons in the continental United States. It is, nevertheless, a serious complication which may easily be obscured by the initial stages of amebic dysentery, and conversely it may be the most prominent presenting symptom in the prodromal and early phases of the disease. It offers a difficult problem not only in diagnosis but in treatment, as surgical wounds in an intestinal tract infected with amebas heal with reluctance and one is hesitant to intervene unless the appendicitis is fulminating.

The following case of acute appendicitis in amebic dysentery with operation at sea is presented. The patient was a passenger from a tropical country to the United States.

Case report.—A 27-year-old Army sergeant presented himself at sick call in the midst of a small epidemic of gastro-enteritis, on 21 November 1944, complaining of abdominal pain and diarrhea of several hours' duration. There had been no vomiting, but anorexia was experienced. He had been in previous good health, and had had no other episodes of diarrhea or abdominal pain. General physical examination was not unusual except for abdominal tenderness in the right lower quadrant without spasm or rebound pain. The temperature was normal. The patient was given paregoric for the diarrhea without relief.

On the following day he still complained of abdominal pain which was most severe in the right lower quadrant. He had vomited once. Examination of the abdomen revealed great tenderness over McBurney's point, with spasm and rebound pain. Rectal examination yielded negative results except for external hemorrhoids. The leukocyte count was 14,750, with 82 percent polymorphonuclear leukocytes. The urine was within normal limits. Appendectomy, with the use of spinal anesthetic, was performed through a McBurney incision. The distal third of the appendix was acutely inflamed and swollen and the serosa markedly injected. The proximal appendix was not inflamed and the cecum appeared normal. Upon opening the appendix, after operation, the distal third contained creamy pus and the mucosa was hemorrhagic and edematous. No gross ulcerations were noted.

On 24 November the patient's postoperative course, which had been uneventful, was altered by an abrupt rise in temperature to 102.8° F., with

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sweating, abdominal distention, and diarrhea. Examination showed abdominal distention with no localized tenderness, and active but not high-pitched peristalsis. Examination of the chest did not disclose any abnormality.

On the following day the patient had several loose watery stools, examination of which disclosed many red blood cells and many typical specimens of active Endamoeba histolytica. Specific therapy with emetine hydrochloride, grain 1, daily, was begun and supplemented by penicillin, 20,000 units every 3 hours. The intake by mouth was restricted, and he was given 2,000 cc. of 5-percent dextrose intravenously. X-ray examination of the chest yielded negative findings and of the abdomen showed great distention of the large bowel and practically no small bowel distention.

Two days later the patient was worse; the temperature was 104° F. and the pulse rate 140 beats per minute. The diarrhea had stopped and the distention which developed was partially controlled by inserting a Levine tube. The emetine hydrochloride and the penicillin were continued. Also 3,000 cc. of 5-percent dextrose in saline and 1,000 cc. of amigen were given by vein. The next day improvement was definite, the temperature had dropped to 102° F. and the pulse rate to 110 beats per minute. The operative wound was dressed and was clean. Treatment was continued as on the previous day.

Two days later the patient's condition had further improved, the temperature had dropped to 100° F. and the pulse rate to 90 per minute. The abdominal distention was partially relieved by the passage of gas by rectum and the patient was given nourishment by mouth. The penicillin was stopped and he was transferred to a nearby Army hospital for convalescence. On 14 December it was reported that the patient was up and that his temperature had been normal for several days. The course of emetine hydrochloride therapy had been completed and carbarsone therapy instituted. The amebas had disappeared from the stools.

COMMENT

The frequency of appendiceal involvement in intestinal amebiasis in the living is not known and cannot accurately be determined. Reports (*1*) (*2*) (*3*) of suppurative amebic appendicitis found at postmortem examination give the incidence as ranging from 7 percent to 40 percent. Craig states that in his cases the process appeared to be chronic or subacute. The experience in the Chicago epidemic of 1933 indicated clearly the seriousness of acute appendicitis in amebic dysentery and further demonstrated that appendectomy in these cases was accompanied by a high (41 percent) mortality. It is acknowledged, however, that the amebiasis was not recognized promptly in many instances, as these patients were widely distributed throughout the country.

In any event there will be certain patients with amebic dysentery and acute appendicitis who will be subjected to appendectomy because of clinical findings which suggest impending perforation, or because acute appendicitis is the presenting symptom of the amebic dysentery; the latter may not manifest itself until the postoperative period. If appendectomy has been performed, intensive

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treatment of the dysentery is imperative to insure healing about the appendiceal stump.

The case which has been presented is unusual because the patient appeared at sick call in the midst of a mild epidemic of nonparasitic gastro-enteritis, because at operation the appendix had the gross appearance of acute fulminating appendicitis, and because the symptoms of amebic dysentery did not develop until the second postoperative day, at which time Endamoeba histolytica was demonstrated in the stools. Intensive treatment with emetine hydrochloride was begun at once and supplemented by penicillin, not as a therapeutic measure against the amebiasis, but to control any concomitant bacterial infection (*4*).

It is probable that in most cases of appendectomy in acute amebiasis, the diagnosis will not be apparent until the postoperative period. This case illustrates such a situation and shows that the patient's chances of recovery depend upon the early recognition of the amebic dysentery and upon immediate intensive treatment with emetine hydrochloride, on intestinal rest, maintenance of electrolytic fluid balance, and amino acid requirements.

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PENICILLIN IN CHRONIC ULCERS

Rapid healing occurred in 5 cases of early ulceration in which there was minimal fibrosis around the edges and good arterial blood supply. The time required for healing in these cases varied from 10 days to 10 weeks.—LOVELL, D. L.: Penicillin; its topical use as bacteriostatic agent for palliative treatment of chronic stasis ulcers of lower extremities. Arch. Surg. 51: 22-27, July-August 1945.

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ALVEOLAR RESORPTION DUE TO OCCUPATIONAL TRAUMA

REPORT OF A CASE

JAMES L. BRADLEY
Commander (DC) U.S.N.

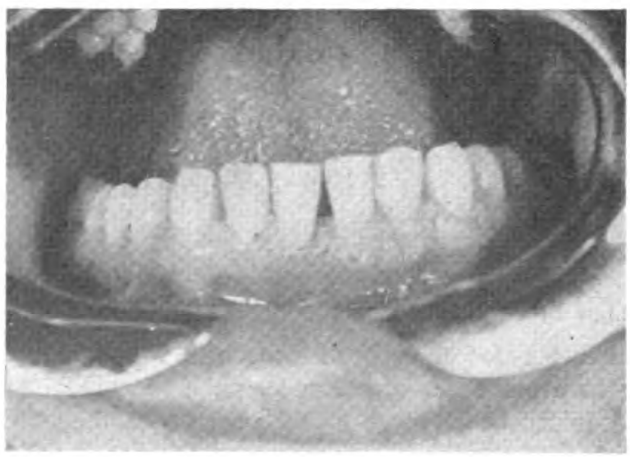
Musicians are apt to exert abnormal pressure on anterior teeth when playing wind instruments and so traumatize the supporting structures. In some instances this trauma can be mitigated by the provision of suitable appliances. Such a case is reported here.

Case report.—A musician, second class, 32 years of age, was referred to the Naval Dental School for consultation. He had played woodwind instruments for 16 years prior to admission and had, for a year, noticed looseness of his mandibular incisors and some ulatrophy.

Clinical examination revealed moderate ulatrophy labial to the mandibular central incisors, absence of caries, and good oral hygiene (fig. 1). Class 2, division 1 (Angle) malocclusion, probably caused by tongue action and gripping of the musical instrument, was present. In protrusive excursions of the mandible it was seen that these teeth were subjected to abnormal stresses. Gingival pockets to a depth of 4 to 5 mm. were found about these teeth.

The roentgenographic examination showed bone resorption extending practically to the root apices of the mandibular incisors (fig. 2). Careful scrutiny revealed the presence of remains of the bony matrix extending halfway up

1. (Below). Mild recession about the labial surface of the mandibular central incisors.

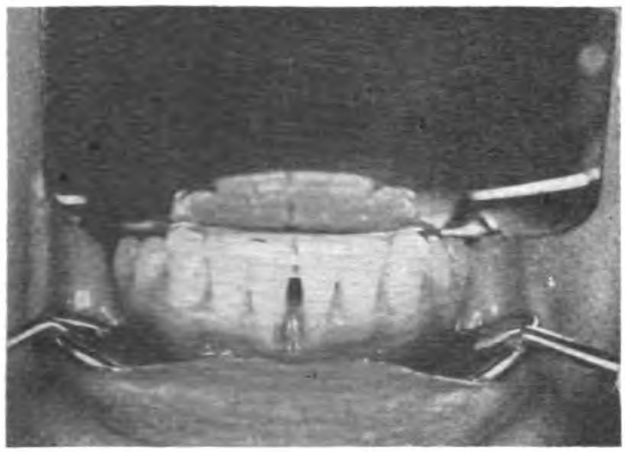


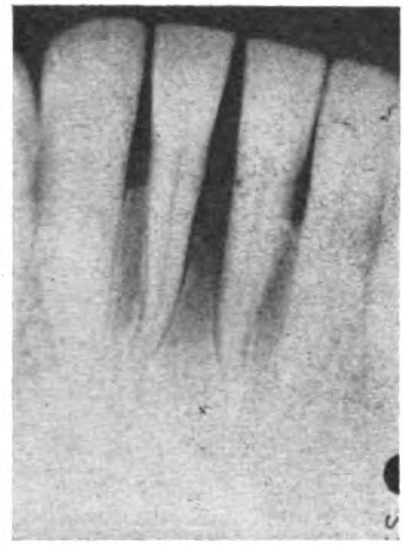


2. (Right). Roentgenograph showing bone resorption almost to the apices.

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3. (Below). Acrylic splint which supports the incisal edges of the incisors and cuspids.





4. (Right). Roentgenograph at 12 months showing a substantial increase in radiopacity of the supporting bone.

the roots. This finding was contrary to what would generally be expected from the clinical observation as to the depth of the gingival pockets.

Incisal stress was reduced, a thorough oral prophylaxis and instruction in stimulation of the interproximal tissues was given, and gingivectomy, removing tissues down to the epithelial attachment, was performed. Ten days after that an acrylic splint covering one-third of the crowns of the incisors and cuspids was provided which the musician was instructed to insert while playing any wind instruments (fig. 3).

Three months after this treatment a definite increase in the radiopacity of the bone at the apices of the incisors could be seen. After 12 months a very substantial increase in radiopacity was apparent (fig. 4). Clinically the teeth became firmly attached and the former motility was eliminated.

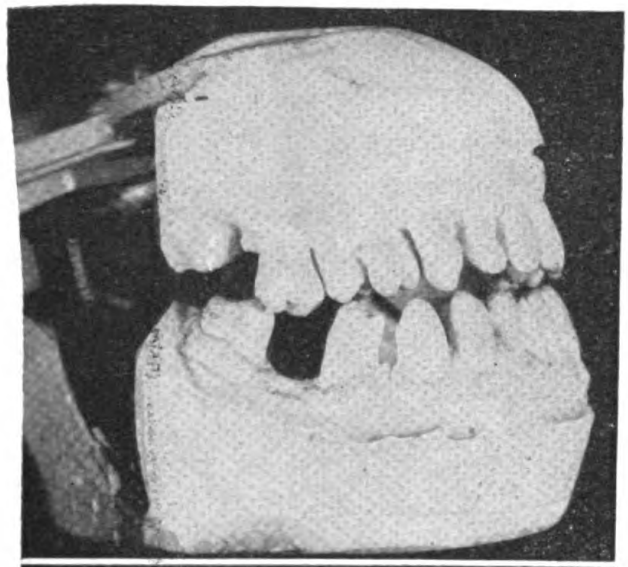
SIMPLE MANAGEMENT OF OPEN BITE

REPORT OF A CASE

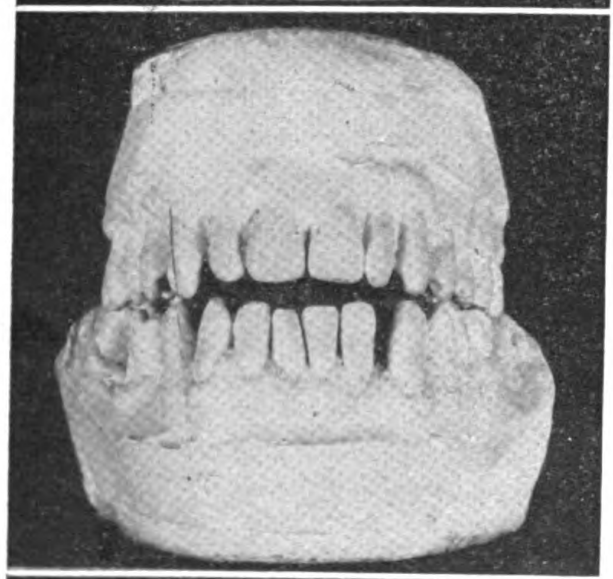
WILLARD J. GOLDRING
Commander (DC) U.S.N.R.

This report of a case of correction of an open bite is presented not to describe a complicated technic, but to demonstrate how easily and simply certain malocclusions can be corrected. Many patients go through life, as did the one in the present case, not

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1. Study casts of case prior to treatment. (a) Shows lack of occlusion, right side.



(b) Marked open bite.

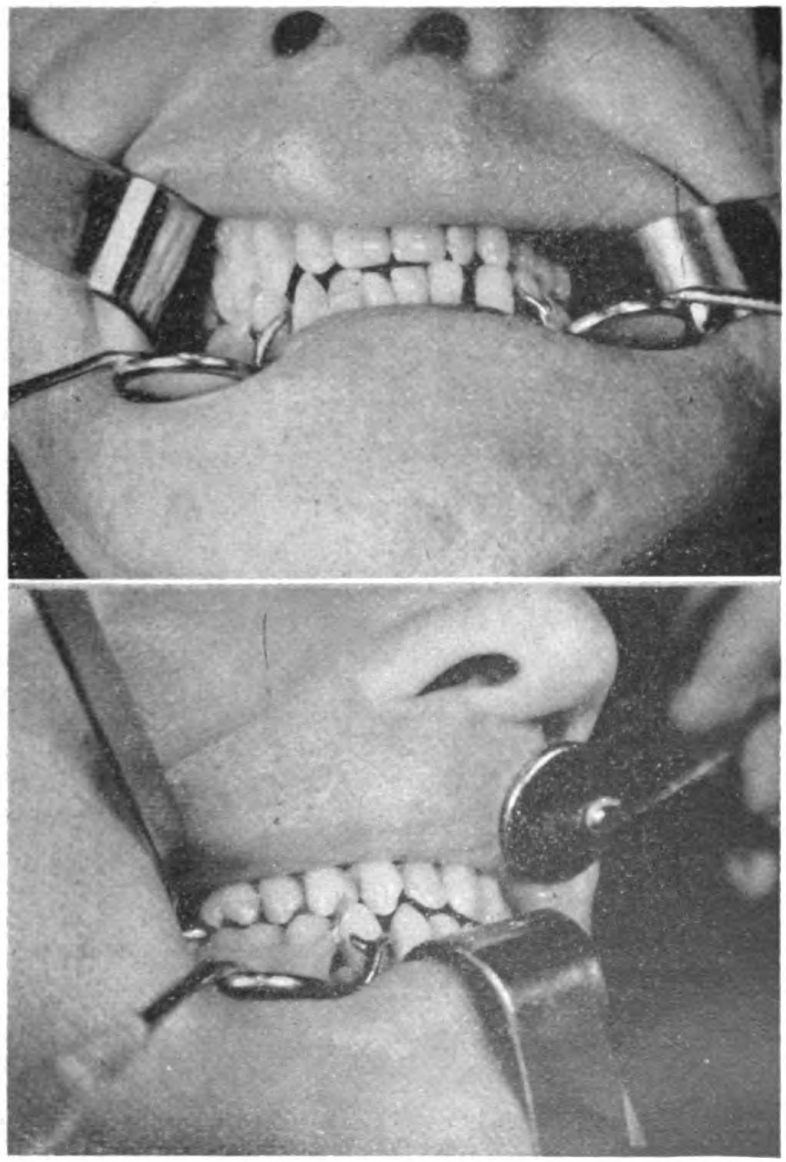


(c) Inadequate occlusion, left side.

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masticating their food properly and in general suffering many oral discomforts because of traumatic occlusion, lack of functional occlusion, or both.

Case report.—An officer, 53 years of age, with 33 years' Naval service, appeared for dental examination and treatment. He stated that all his chewing was, for practical purposes, accomplished by two posterior teeth and that he had never been able to use his anterior teeth for biting.



2. Appearance of the mouth showing improved functional occlusion.

Figure 1(a) illustrates occlusion on the right side prior to treatment. Figure 1(b) shows the complete lack of function of the anterior teeth. Figure 1(c) shows the only teeth that could be said to be in reasonably good functional occlusion.

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Two sets of casts were constructed and mounted on articulators in centric relation. With the idea in mind of grinding the teeth in the mouth a corresponding amount, the teeth on one set were cut away sufficiently to provide normal closure. It was apparent that the amount of grinding required would be too extensive to consider. With the most conservative method of handling this problem out of the question, further study of the casts disclosed that the mesial marginal ridge of the mandibular right molar and the distal marginal ridge of the maxillary right molar (the latter being restored with large disto-occlusal amalgam fillings) would stand considerable grinding without damage and that a certain amount of grinding of the buccal cusps of the first bicuspids on both sides could be done.

This was accomplished and coincidentally the mandibular right and left second premolars and the left first molars were extracted.

Subsequently a cast gold partial denture, with acrylic saddles, supplying the missing teeth was inserted (fig. 2(a) and (b)) show the denture in place.

The patient is now much more comfortable and derives a great deal of satisfaction in being able properly to bite and chew for the first time in his life.

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EXPERIENCES WITH THE MILLER-ABBOTT TUBE

The Miller-Abbott tube has made the small intestine accessible for physiologic observation, diagnosis, and therapy. Used prophylactically before operation, the tube has been successful in decreasing the incidence and clinical severity of postoperative ileus associated with operations upon the small intestines, large hernias, resections of the colon, and in the presence of peritonitis.

In right colectomy its advantages have been so striking that its rather universal use has permitted a single-stage resection to displace the formerly considered more conservative method of two-stage resection, with enterostomy.

Whereas it has also been useful in deflating the small intestine following resections of the left colon and rectum, it has not been as effective in these cases in deflating the remaining colon, and thereby obviating the necessity of a proximal colostomy.

Postoperatively it has deflated the stomach, but it should not be used primarily for this purpose. Its greatest function is deflation of the small intestine.

This tube has been a means of preoperatively diagnosing the presence and site of small intestinal tumors, foreign bodies, adhesions, kinks, bands, bleeding sites, and malformations. At operation, it has served as a guide to the site of obstruction. It has also permitted the small intestine to be, so to speak, pleated on the tube, thereby facilitating the retraction of the small intestine from the operative area.—SMITH, B. C.: Experiences with Miller-Abbott tube. Ann. Surg. 122: 253-259, August 1945.

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DOUBLE GALLBLADDER

REPORT OF A CASE

WARNE L. HAIGHT
Commander (MC) N.S.N.R.

A twin gallbladder is rare. Boyden (*1*) found a double gallbladder 5 times in 19,000 autopsies, or an incidence of 0.026 percent. The same author in reviewing the literature from 1674 to 1926, found only 20 cases (*2*). In 1936 Gross (*3*) reviewed the literature and found 28 cases.

Cholecystographic diagnosis of double gallbladder has not often been made. In 1929 Climan (*4*) first reported a double gallbladder demonstrated by cholecystograms. In 1931 Hayes (*5*) reported 1 case, Cave (*6*) 2 cases, and Golob and Kantor (*7*) 2 other cases in 1942, all visualized by cholecystography. Golob and Kantor considered their 2 cases to have been the seventh and eighth which were diagnosed by cholecystograms. In the cases reported by Sherren (*8*), Braun (*9*), and Nichols (*10*), there was nonvisualization of the gallbladder, and the roentgenographic diagnosis was made by visualization of two separate rows of stones.

The simplest classification of double gallbladder as arranged by Cave is: (1) Ductular gallbladder, developed from either the hepatic, cystic, or common bile ducts; and (2) bi-lobed gallbladder draining into the common duct by a single duct. Of the 20 cases in Boyden's review, 17 were of the former type, from which it appears that this is the more common type. Calculi may be present in one or both gallbladders.

Case report.—A 26-year-old staff sergeant was admitted to the hospital in December 1943 with a tentative diagnosis of peptic ulcer. The patient complained of burning distress in the epigastrium, since May 1942. There was no periodicity to the distress nor was it induced by any particular type of food. It was relieved by soda tablets, but later no relief was obtained from antacids. There was relief on ingestion of food.

A gastro-intestinal series revealed a suspicious niche in the duodenum. Sippy management gave relief and the patient was discharged to duty in 5 weeks. The symptoms recurred 3 weeks later and the patient returned to the hospital. The history at this admission revealed that he had "heartburn all his life, attacks of indigestion every 6 months, and gas pains." The physical examination was negative except for a point of tenderness just below the ensiform and under the right costal margin.

The roentgenogram on admission showed no evidence of ulcer. Gallbladder visualization revealed two well-defined gallbladders which concentrated the

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Cholecystogram showing two gallbladders.

dye normally and emptied normally. There was no cholelithiasis. The smaller and more inferior of the two organs had a well defined cystic duct which turned medially and crossed the neck of the other at right angles, from whence it ran caudad. The cystic duct of the larger structure was not visualized. Gallbladder visualization was repeated for additional views. On Sippy regimen for 5 weeks the patient had no complaints, and he was discharged to duty.

COMMENT

Doubling of the gallbladder is a rarity. However it is interesting to speculate on two possible clinical problems which it might present: (1) A patient with clinical cholecystitis affecting one gallbladder, causing nonvisualization, and the other functioning normally by cholecystogram; and (2) both organs being the seat of chronic cholecystitis with nonvisualization of both organs, sur-

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gical removal of one, the other being either buried in the liver substance or overlooked at operation.

SUMMARY

A case of double gallbladder, presumably with separate cystic ducts, is added to those reported in the literature. The diagnosis was established by cholecystographic examination.

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SUNBURN NOT CAUSED BY HEAT

The first clear recognition that sunburn is not caused by heat, but by an invisible portion of the sun's rays seems to have come with the accidental finding that the same phenomenon results from exposure to the radiation emitted by electric arcs. Certain physicists made this discovery sometime previous to 1858, and correctly attributed the effects to ultraviolet radiation. Only in 1889, however, was there clear-cut experimental demonstration, when Widmark showed that the rays of the carbon arc passing through quartz produced sunburn, whereas those rays passing through glass did not. Since glass cuts out much of the ultraviolet radiation which is passed by the quartz, this experiment set the long wavelength limit for sunburn somewhere in the ultraviolet, and showed that visible radiation is incapable of eliciting the response.—BLUM, H. F.: Physiological effects of sunlight on man. Physiol. Rev. 25: 483-530, July 1945.

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GELATIN SPONGE FOR HEMOSTASIS

Recently a foam-like sponge, the essential ingredient of which is gelatin, was developed for the application of human thrombin. Its use as a hemostatic agent in neurosurgery was subsequently investigated. Pilcher and Meacham of Vanderbilt University determined its efficacy on dogs and concomitantly invited reports from a group of 11 neurosurgeons who used the sponge in 291 operations. Every investigator found the sponge satisfactory in the great majority of his cases and most preferred it to fibrin foam because of greater ease in handling. The sponge has no tendency to crumble or fragment, can be cut with a knife or scissors when either wet or dry, and retains excellent tensile strength when wet. In only 3 of 115 cases did the surgeon consider the sponge inferior to fibrin foam. It was considered superior in 70 cases but equally satisfactory in forty-two.—PILCHER, C., and MEACHAM, W. F.: Absorbable gelatin sponge and thrombin for hemostasis in neurosurgery; experimental and clinical observations. Surg., Gynec. & Obst. 81: 365-369, October 1945.

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EXOPHTHALMIC GOITER

Graves' disease is a psychosomatic disease and its clinical expression represents a hyperkinesis of many normal bodily functions, the dominant one being the normal basal metabolic rate. The background is a constitution mostly psychic in makeup largely conditioned by environmental factors, and the disease attains its fullest fruition usually as a result of either a catastrophic or a prolonged psychic strain. Between the background and the fully developed form occur a host of clinical expressions that have received different eponyms in the past. These merge into themselves so imperceptibly that it is sometimes extremely difficult to determine when the disease begins and when the constitution ends, and it is only by a study or a reconstruction of the total organ-personality, together with an adequately prolonged follow-up, that the biology of the disease can be recognized. By so doing, the biologic course will be found to be in both directions, sometimes forward toward hyperkinesis and sometimes the reverse, toward regression, depending upon the individual's reaction to his environment.—MOSCHCOWITZ, E.: Essays on biology of disease; the biology of Graves' disease. J. Mt. Sinai Hosp. 12: 828-832, July-August 1945.

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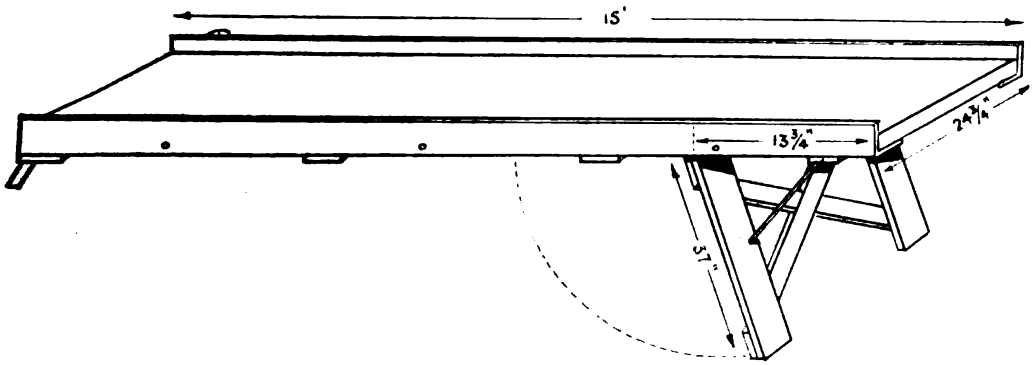
MEDICAL AND SURGICAL DEVICES

CASUALTY HANDLING ON AN ATTACK TRANSPORT

LYNN FORT, JR.
Commander (MC) U.S.N.R.

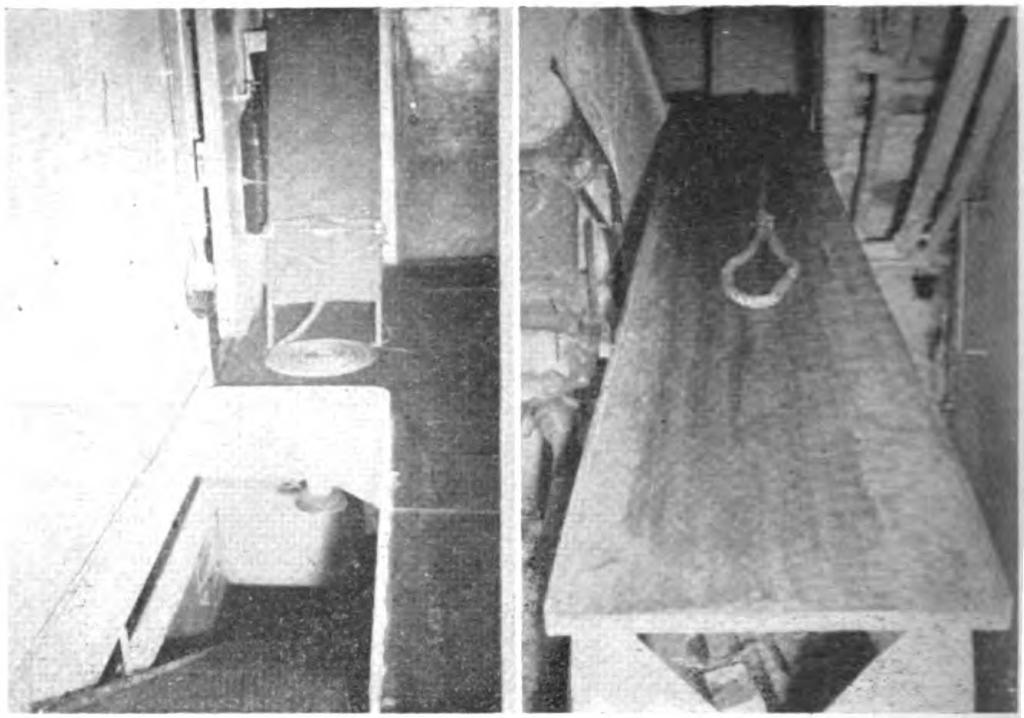
One of the major problems of the medical department on this transport was the lowering of severely injured and wounded men from the sickbay area on the main deck to bunk spaces on the deck below. The ladder was quite narrow and the incline steep. At the outset a pole litter, with the wounded man strapped to it, was passed from hand to hand down the ladder after first removing the outer rail. This was a slow process and one that required six or eight men to move each litter. The use of block and tackle was considered, but due to the extremely small area it was found infeasible.

The problem was solved, however, with the employment of a slide, similar to those used by children in a playground and constructed very much along the same lines. As the width of a pole litter is 23 inches, the slide was constructed 24¾ inches in width. The ladder and its rail are removed and stowed, and are replaced by the slide. The upper end of the slide is attached to the deck

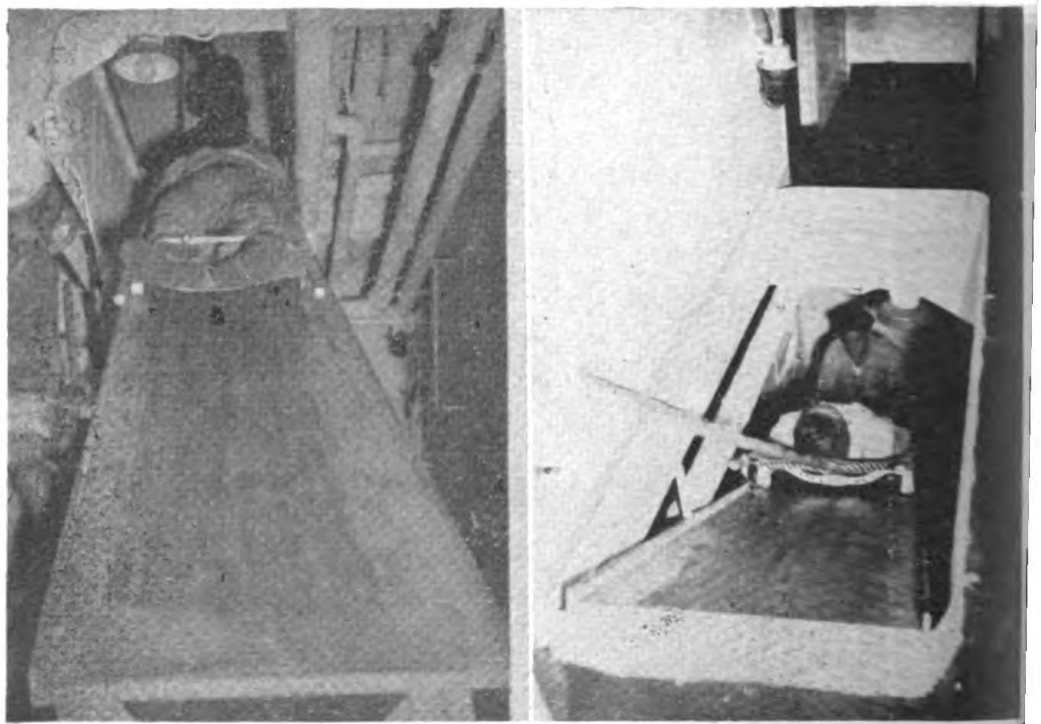


1. Sketch showing dimensions of litter slide.

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2. (Left) View from above with slide in place; pole litter in background. (Right) Seen from below.



3. (Left) View from below, patient being lowered. (Right) Seen from above, stretcher being removed from slide.

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above by metal hooks. The lower end of the slide stands on 37-inch legs. The length of the legs is important in decreasing the decline and facilitating easy removal of the stretcher below. The patient is strapped to the litter by bunk straps before lowering.

As can be seen in the diagram the slide is in one piece with folding legs. When not in use it is readily secured against the bulkhead and is not in the way.

A line with a large eye placed around the two upper legs of the litter controls the descent. One man can handle this line, or can easily hoist the litter up a slide with the incline indicated. If necessary the slide can be greased or waxed, though this was not found necessary in practice.

ACKNOWLEDGMENT.—The author wishes to express thanks to Commander C. Reed Gennaria (MC) U.S.N.R. and Chief Pharmacist's Mate Matthew Pulliam U.S.N.R., for full development of the above idea.

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WHITEHEAD DEFORMITY

To answer the question as to what was wrong with Whitehead's work: The answer is that nothing was wrong with the work of Whitehead himself. The "wrong" was done to the name of this great surgeon by the less skillful ones who were unwilling to take the blame for their own mistakes or mishaps. There is no more justice in dubbing a recurrent inguinal hernia after repair a "Bassini deformity" than in calling the "ectropion of rectal mucosa" following an improper amputative hemorrhoidectomy a "Whitehead deformity."—EATON, C.: What was wrong with Whitehead's work? An appraisal of his rectal operation. Am. J. Surg. 70: 83-85, October 1945.

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HIGH DOSAGE VITAMIN C IN ALLERGY

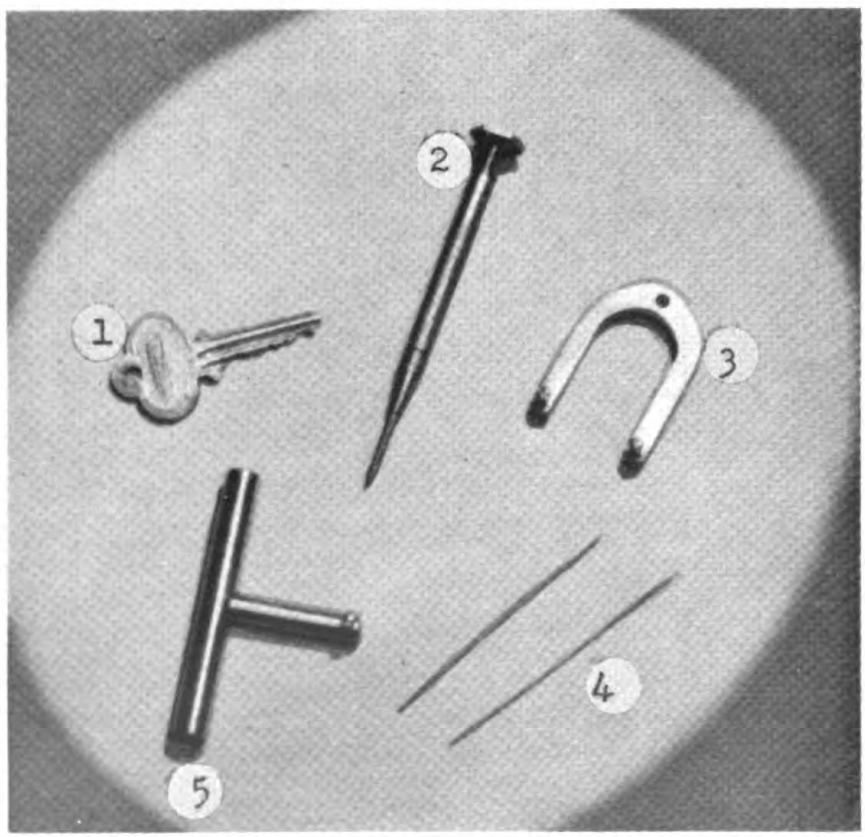
Vitamin C plays a valuable role in the treatment of nasal allergy, but is useful fundamentally in large doses ranging from a minimum of 250 mg. daily with an optimum dosage of 750 mg. daily. Vitamin C is useful in allergy either by oral therapy or by injection. The results of the administration of vitamin C are in general advantageous to allergic patients with or without desensitization. In some cases vitamin C therapy alone proved superior to pollen desensitization in previous years. Allergic disturbances are related to nutritional deficiencies, primarily that of ascorbic acid.—RUSKIN, S. L.: High dosage vitamin C in allergy. Am. J. Digest. Dis. 12: 281-313, September 1945.

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SMALL TYPE SKELETAL TRACTION APPARATUS

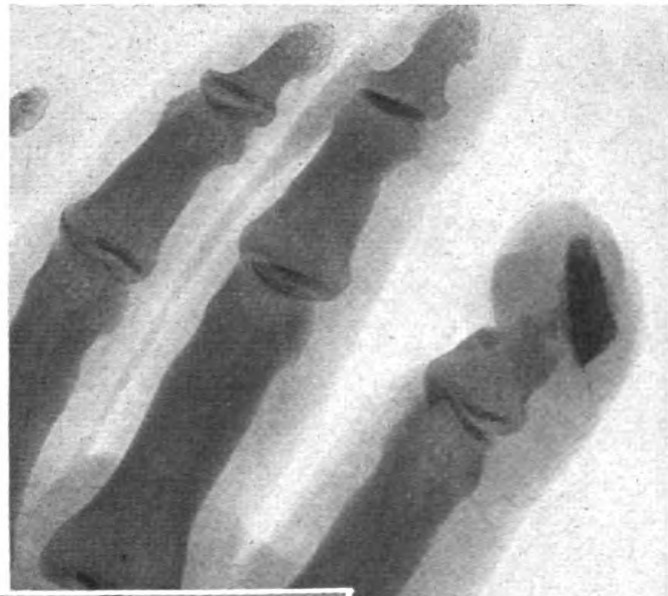
BENJAMIN J. BOND
Lieutenant Commander (MC) U.S.N.R.

Fracture of the phalangeal and metacarpal bones is one of the most common types of fractures in the Navy. For their immobilization an apparatus consisting of a horseshoe-shaped traction apparatus with holes through the tips for the pins and set screws to hold the pins has been devised (fig. 1). The pins are made of piano wire with one end having a trochar-type point. The handle for inserting and removing the pins is "T" shaped with a small hole through its long axis with a set screw.

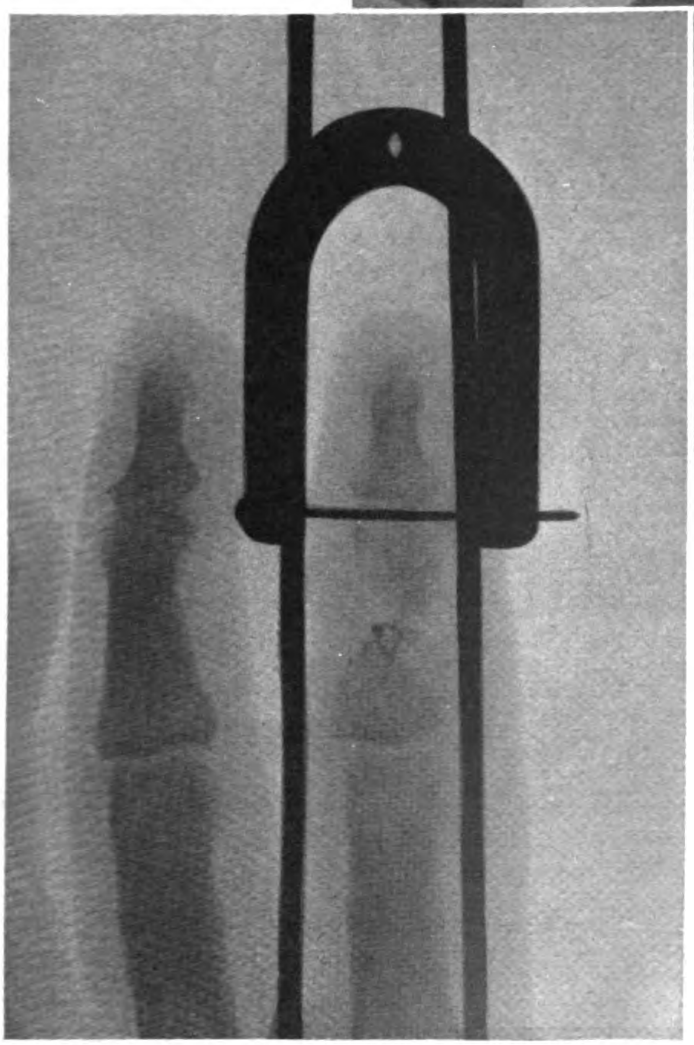


1. The traction apparatus disassembled with handle for inserting and removing the pins. **(1)** Key to show size; **(2)** small screw driver; **(3)** traction apparatus; **(4)** piano wire pins with three-sided point; **(5)** handle for inserting and removing pin.

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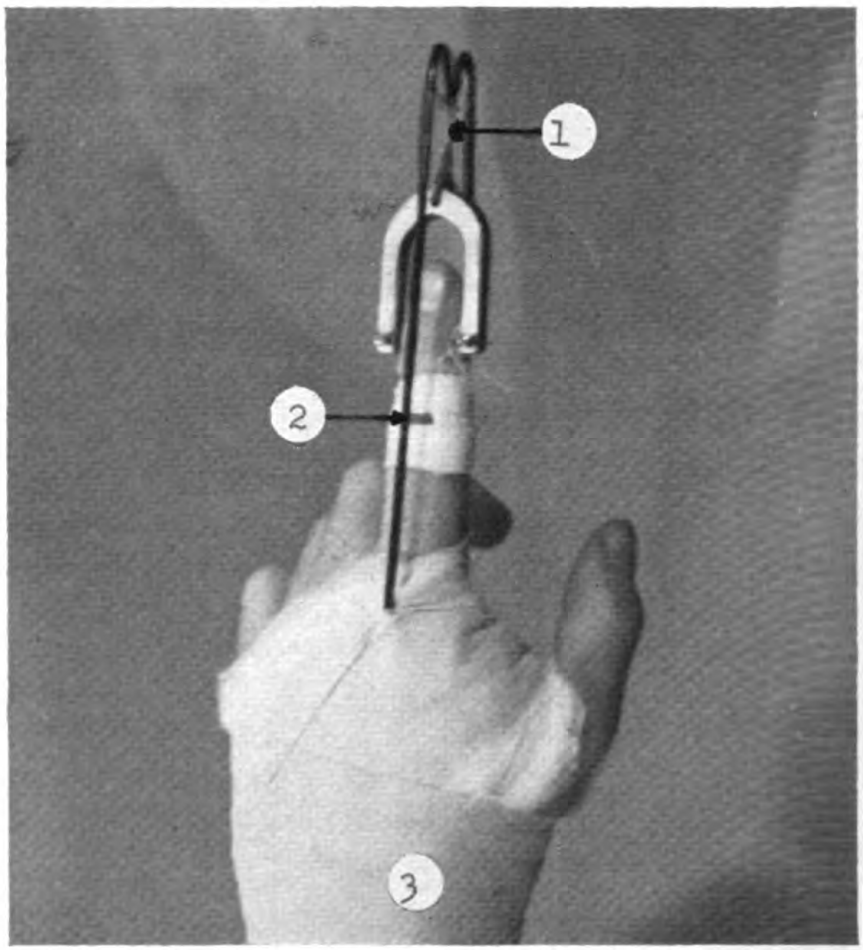
2. A compound comminuted fracture of the middle phalanx of the index finger of the left hand with a badly mangled finger and doubtful blood supply to the end of the finger.



3. Conservative treatment resulted in healing with overlapping of fragments. An open reduction was done, and the bone ends freed and held together with a small steel wire. The traction apparatus with a banjo splint was applied and traction made by a rubber band, resulting in extension of the finger to its normal length.

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The assembled instrument can be used on the common types of fractures of the phalangeal and metacarpal bones of the hand as well as on fractures of the phalangeal and metatarsal bones of the foot (figs. 2 and 3). An added advantage of the apparatus is that the operator has a positive control over the distal fragment (fig. 4).



4. Full view of the apparatus applied with the wire through the distal fragment and with traction by means of rubber band: **(1)** Rubber band for traction; **(2)** banjo splint made from wire coat-hanger; **(3)** plaster cuff on hand.

This is a very simple type of apparatus and if properly used will prevent many deformities of the hands and fingers. This apparatus is made of stainless steel (duraluminum is preferable because of its lightness and ease in handling during production).

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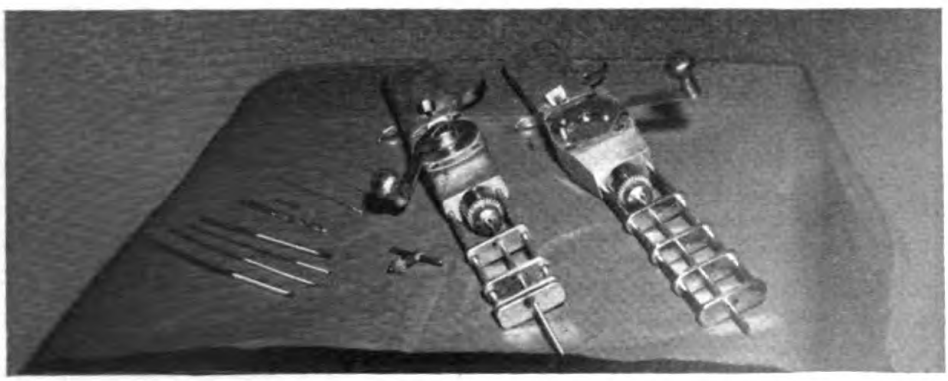
NEW TYPE SURGICAL HAND DRILL

JOSEF H. GIESEN
Commander (MC) U.S.N.R.

The need of a new type surgical hand drill since the advent of newer technics of pin transfixion, and especially since the increased use of plate fixation for various types of fractures of the long bones is apparent. It is practically impossible to adapt the conventional surgical drill to any other than the application of Kirschner wire and the drilling of bone in preparation for the insertion of Sherman or other types of bone screws.

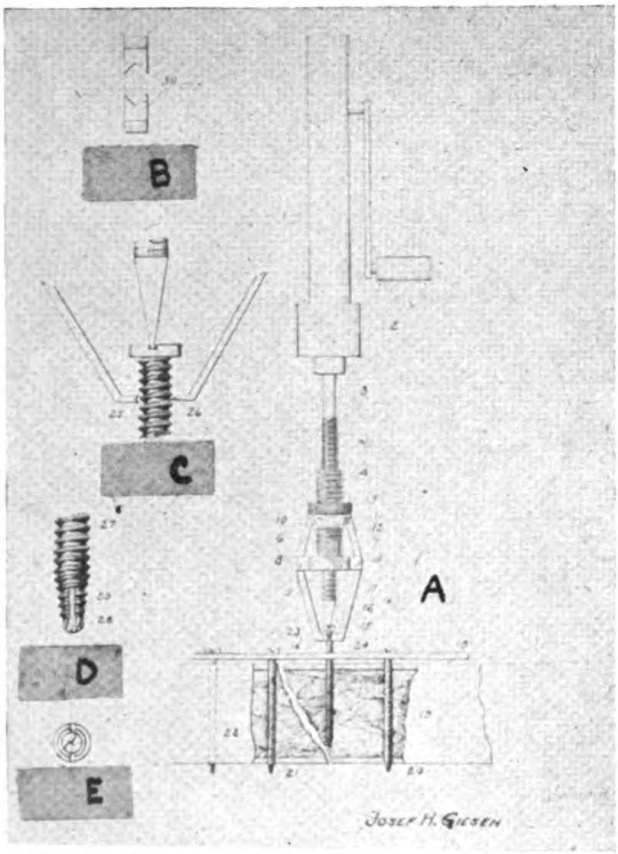
With the new type drill the following is possible: The insertion of pins, either threaded or plain, in sizes ranging from the 22-gage Wassermann needle (with the hub removed), up to and including the ¼-inch stainless steel pin either threaded or plain (fig. 1). In the application of larger sizes it is not necessary to make a drill hole beforehand, as a combination drill and tap has been constructed on the various sizes of threaded pins (fig. 2, D and E). This combination of drill, tap and thread is not new but has been used for years in machine-shop practice and applies efficiently to bone surgery. The ordinary surgical drill with the short handle and speed ratio of 3:1 (one turn of the handle equalling three turns of the drill) has been unsuccessful because of the great speed combined with too little power for insertion of any but the Kirschner wire size of pin.

This new drill has the following features constructed within it

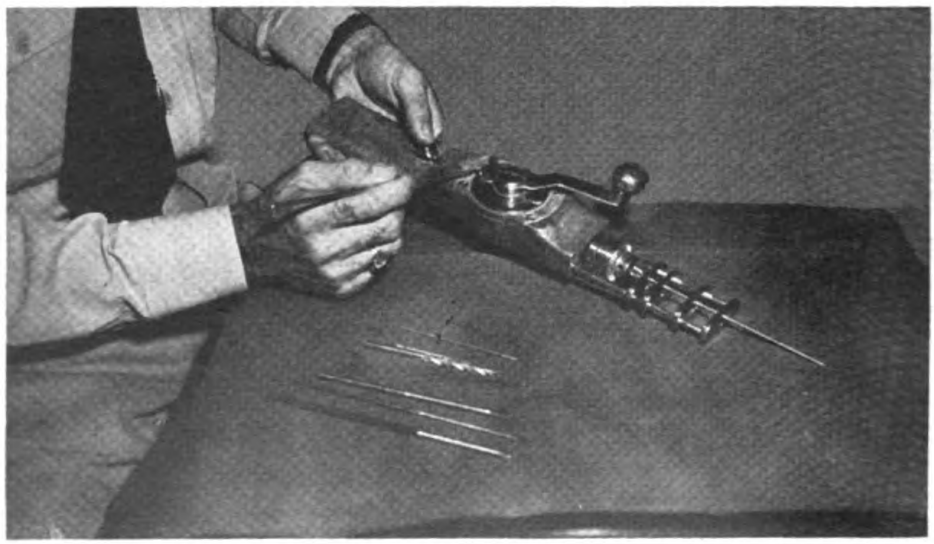


1. The assembled hand drills with various sizes of threaded pins up to and including ¼-inch shown on left.

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2. Bone screw holding attachment for surgical hand drill.



3. Two-speed surgical hand drill without ratchet (left thumb is applied to sliding bar mechanism). Pointer indicates gear changing mechanism.

which are not found in the conventional drill on the market:

1. A simple sliding-bar locking device which locks the handle when the drill chuck is tightened. This prevents the annoying turning of the drill handle (fig. 3).

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2. A new principle has been constructed in the drill guide which permits the collapsible drill guide to accommodate four different sizes of pins; the ordinary surgical drill accommodates but one size Kirschner wire.

3. Two speeds have been constructed within the drill. One of these is a 3:1 ratio; the other is a 1:1 ratio. By this means the larger size pins can be driven in at very slow speed. This prevents the formation of heat at the drill point and minimizes the danger of bone necrosis at the point of application. There is the higher speed of 3:1 ratio for application of the Kirschner wire and the smaller sizes of plain or threaded pin.

4. The handle of this drill is made longer than that of the ordinary drill but is not of excessive length. This permits ease of operation, adds tremendously to the power, and allows the ¼-inch threaded pin to be applied to the femur or other long bone without strain.

5. A ratchet-type handle has been successfully constructed into this instrument which permits clockwise and counter-clockwise movement of pin or of bone screw. By the use of this instrument the Sherman bone screws can be driven into the femur or any other long bone directly. This is done quickly, easily, and without the use of the screw driver, which is an annoying, protracted procedure.

6. In order that positive clockwise and counter-clockwise motion of the pin can be obtained without the annoying release of the chuck, the standard "2A" Jacobs chuck is used.

7. A design for a bone screw holding attachment has been perfected and is now being constructed which will permit the operator to insert Sherman or other type bone screws in any desired direction without the aid of an assistant.

Notwithstanding the many mechanical features, the instrument is only slightly larger in size and slightly heavier than the conventional drill.

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BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.
(For review)

THE MANAGEMENT OF OBSTETRIC DIFFICULTIES, by *Paul Titus, M.D., Obstetrician and Gynecologist to the St. Margaret Memorial Hospital, Pittsburgh; Consulting Obstetrician and Gynecologist to the Pittsburgh City Homes and Hospital, Mayview, and to the Homestead Hospital, Homestead, Pa.; Secretary of the American Board of Obstetrics and Gynecology; Commander (MC) USNR, attached to Professional Division, Bureau of Medicine and Surgery, Navy Department, Washington, D.C.* 3d edition. 1,000 pages; 426 illustrations and 8 color plates. The C. V. Mosby Co., St. Louis, Mo., publishers, 1945. Price $10.

The third edition of "Management of Obstetric Difficulties" by Paul Titus, fulfills expectations. As in previous editions, the author has presented, in his discussion of each phase of his subject, the views of many writers, scrupulously giving credit to all acceptable methods of treatment. His comments on these procedures, sometimes favorable and sometimes not, are carefully considered, based on his own extensive knowledge and experience.

This edition has been brought up to date on the subject of obstetrical analgesia and anesthesia by a thorough discussion of caudal anesthesia.

A brief but comprehensive explanation of the Rh factor in its relation to erythroblastosis foetalis gives a workable outline of what is currently known about this widely discussed but not entirely understood condition. The indications for the methods of administration of various sulfa drugs and of penicillin are described in detail.

Of particular interest is a new classification of the toxemias of pregnancy, which apparently covers all of the manifestations of this complication.

Following the practice adopted in the earlier editions the num-

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ber of the chapter appears at the top of each right-hand page, which greatly facilitates the locating of chapter references.

The appearance of the book is somewhat marred by the fact that, owing perhaps to imperfections of the type or to inequality of the impression, certain lines stand out with a degree of blackness that is somewhat startling. This has the effect of emphasizing some statements that are relatively unimportant, and detracts from the ease of reading which otherwise characterizes the book.

"Management of Obstetric Difficulties" is undoubtedly one of the best books ever published on this subject and should be in the library of every person who does obstetrics, as a guide to those whose participation in this field is only occasional, and as an authoritative reference work for students and specialists.

MEN UNDER STRESS, by *Roy R. Grinker, Lt. Col., M.C., and John P. Spiegel, Major, M.C., Army Air Forces.* 484 pages. The Blakiston Company, Philadelphia, Pa., publishers, 1945. Price $5.

Mankind has come a long way forward. At long last it frankly acknowledges what the men who fight the wars have always known —that wounds and death are not the sole cost of a war to the soldier. A large part of the reckoning and wastage is paid in never-ending tension and anxiety. For the most part physical wounds and physical disease are easily borne. To have fought and bled and fallen is an honorable estate which all men in all times have acknowledged because they understood the cause and effect relationships. Yet for reasons which seem to be ingrained in the structure of human society itself, the psychologic reactions to the stress of combat have always been somewhat obscured in a penumbra over-shadowed by the more tangible physical picture and hidden by misunderstanding.

Colonel Grinker and Major Spiegel in their exposition of the nature and mechanics of the psychologic reaction of flying personnel to combat, detail the erosion, the grinding, and the pulverization of stress. Theirs is a fully documented account, clearly presented with illustrative case histories as important highlights.

In many ways this is a unique contribution. The authors have striven to present their data in simple language. They are deeply aware of the many factors which have contributed to their patients' problems and therefore the dynamic picture which they paint has a gratifying realistic quality. Too often psychiatrists in their writings have rambled discursively with the result that inadvertently they comfounded the uninitiated. Drs. Grinker and Spiegel out of a wealth of clinical teaching experience have caught the knack of presenting a lucid psychopathology.

"Men Under Stress" is unequivocally recommended for laymen

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and physicians alike. It sets a new high standard in medical writing. Every medical officer will find his experiences not only well-described but also logically explained.

PERIPHERAL NERVE INJURIES, Principles of Diagnosis, by *Webb Haymaker, Capt., M.C., A.U.S., Neuropathologist, The Army Institute of Pathology, Washington, D. C.; and Barnes Woodhall, Maj., M.C., A.U.S., Chief Neurosurgical Section, Walter Reed General Hospital, Washington, D. C.* 227 pages; 225 illustrations. W. B. Saunders Co., Philadelphia, Pa., publishers, 1945. Price $4.50.

In this timely volume Haymaker and Woodhall present the essential data on peripheral nerves in a clear, concise and orderly fashion. The large number of line drawings and photographs aid considerably in elucidating the text.

The book is divided into three sections. The first of these concerns the segmental and peripheral innervation of the skin, muscles and skeleton. Motor, sensory and sympathetic components are described.

In the second section the examination of the injured patient is discussed. Among the interesting features of this section are the quick tests to determine if a nerve lesion exists, and the analysis of motion patterns on the basis of the muscles, nerves and spinal segments involved. Accessory methods of examination such as sweating tests, dermometry, electrical excitability of muscles, chronaxia and electromyography are described.

In the final section the clinical features of various plexus and peripheral nerve injuries are discussed. Each nerve is considered separately. The motor and sensory distribution is shown in line drawings. Individual nerve lesions are demonstrated by photographs taken from the files of various Army hospitals.

Medical officers engaged in the examination of patients with peripheral nerve injuries will find this volume a good companion.

THE BASIS OF CLINICAL NEUROLOGY. The Anatomy and Physiology of the Nervous System in Their Application to Clinical Neurology, by *Samuel Brock, M.D., Professor of Neurology, College of Medicine, New York University.* 2d edition. 393 pages. The Williams & Wilkins Co., Baltimore, Md., publishers, 1945. Price $5.50.

Instruction in neurology has usually been separated into distinct departments of anatomy, physiology and pathology, which precede the course in clinical neurology. In order to visualize human nervous functions in their normal as well as their distorted state as the result of disease, integration of neurologic fundamentals and clinical data is essential. If the clinician thinks of symptoms and signs in terms of disordered morphology and physiology rather than as mere words or syndromes, their differential diagnosis becomes an art of interpretation of disease entities in the third dimension.

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Recent advances in medical education have stressed the importance of the correlation of form and function with the interrelationship of organs and systems in the study of the individual as a whole. The test of time has proved that this method of instruction has a broadening effect upon physicians in this period of specialization, with mutual benefit to the patient and the physician.

In this book the author, due to his wide experience as a clinician and a teacher, has presented the subject of clinical neurology in close association with the academically separated aspects of the nervous system. There have been many advances in the various fields of fundamental and clinical neurology since the publication of the first edition. As the result of laboratory investigations and observations made by neurosurgeons, the outstanding advances have been in the field of neurophysiology. The present volume has been revised extensively to include the results of these investigations, noticeable in the discussion of electrodiagnostic methods and electroencephalography. A wealth of information which is difficult to find as a composite picture in the average textbook is presented clearly on such subjects as the hypothalamic control of vegetative functions, the general and special functions of the brain and the vegetative nervous system and its functions.

Undoubtedly the most amazing feature of this volume is the mass of fundamental details associated with clinical application which has been presented so clearly in a book of this size. This book is not only considered an excellent text for medical students, but its greatest value should be found as a standard reference text for medical libraries and a ready reference for the general practitioner of medicine.

PERIODONTAL DISEASES—Part One, Diagnosis and Treatment—Part Two, Soft Tissue Lesions of the Oral Cavity, by *Arthur H. Merritt, M.S., D.D.S., Sc.D., F.A.A.P.* 3d edition. 256 pages; illustrated. The Macmillan Company, New York, publishers, 1945. Price $3.50.

This is an excellent presentation of one of the specialties of dentistry that at times has not received the attention that it has merited. The book, which is now in its third edition, is divided into a first and a second part.

The first part deals with the etiology, diagnosis, prognosis and treatment of these conditions which are essentially in the field of periodontia in its more restricted sense. In reading this part of the book, one is impressed by the close relationship that exists between the practice of periodontia and the practice of general medicine.

The author classifies and subdivides the several periodontal diseases which have at times been grouped together under the general heading of "pyorrhea." He gives the procedure by which a differential diagnosis of these diseases may be made and stresses the

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importance of early diagnosis and treatment of gingivitis as a means of preventing periodontoclasia.

The importance of diet in its relation to periodontia is accentuated. The loss of resistance to stress and not occlusal force is regarded as a prime cause of traumatic occlusion. Traumatic occlusion itself is regarded as a symptom and not an etiologic factor in periodontoclasia.

Several cases of obscure and continued pain are reported, which were eventually diagnosed as hyperemia of the pulp resulting from a moderate gingival recession. A successful method of treating this condition is given.

In the second part of the book the author stresses the frequent early oral manifestation of systemic disease and the responsibility of the dentist, who is usually the first to be consulted, to recognize the true significance of these lesions and to refer the patient to the medical practitioner for his principal treatment. He directs attention to the fact that a mistake in diagnosis in these cases may result in the oral lesions being treated as a local condition while the systemic disease which is the primary cause of the oral lesion goes untreated.

The author also stresses the need of collaboration with the medical practitioner in the treatment of certain advanced cases of periodontal disease.

Perhaps the greatest value of the second part of this book is the aid that it will give the dental practitioner in making a differential diagnosis between truly periodontal disease and the oral manifestations of systemic disease.

PHYSICAL DIAGNOSIS, by *Ralph H. Major, M.D., Professor of Medicine in The University of Kansas.* 3d edition, revised. 444 pages; 458 illustrations, W. B. Saunders Co., Philadelphia, Pa., publishers, 1945. Price $5.

The author presents in a clear, concise, well organized and interesting manner the dicta of physical diagnosis. He gives an adequate historical background of the methods and armamentarium of physical diagnosis, and has drawn freely from classic descriptions and quotations of the masters.

Objective findings upon inspection, palpation, percussion and auscultation are adhered to, and, where practicable, are explained on the basis of applied physics. The findings in the normal and abnormal are adequately discussed. The subjective symptom of pain receives full cognizant value, and is discussed early in the volume. As to thoroughness and length of discussion, the author well proportions the relative value of the various systems when considered from the standpoint of general physical diagnosis.

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This book is particularly enhanced by its wealth of diversified illustrations, consisting of photographs, drawings, phonograms, and sound tracings. Its extensive bibliography is in itself a valuable contribution to the subject.

It is the opinion of the reviewer that the author has admirably presented in this volume an outline and textbook of physical diagnosis. After its consideration, one is aware that "the practiced eye, ear, and finger" have not been antiquated by more refined methods of diagnosis. This book is recommended for the general practitioner in Naval service.

DENTAL CHRONOLOGY—A Record of the More Important Historic Events in the Evolution of Dentistry, by *Hermann Prinz, A.M., D.D.S., M.D., ScD., Dr. Med. Dent. Emeritus Professor of Pharmacology and Lecturer, The Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania.* 189 pages; illustrated with 97 engravings. Lea & Febiger, Philadelphia, Pa., publishers, 1945. Price $3.

This very interesting small book is something more than a mere chronology in that the author at times amplifies the text to include a brief history of important events in the development of dentistry as a profession.

The book is divided into three parts plus an appendix. Part one, Antiquity, is a record of dentistry from the beginning of recorded events until the year 1000 A.D.; part two, The Middle Ages, similarly covers a period from 1000 A.D. until 1728 A.D.; part three, Modern Times, begins with the publication of "Le Chirurgien Dentiste" by Pierre Fauchard, the father of modern dentistry. The appendix contains additional chronologic data relative to dentistry and other items of interest to the dental practitioner.

Several interesting instances in which dentistry has played an important forensic role are recorded. These include: The identification of the exhumed skull of Dr. Joseph Warren by Paul Revere, who was a practicing dentist as well as a skilled metalworker; the famous Webster-Parkman trial in which Professor Webster was convicted of the murder of Dr. Parkman in the Harvard School of Medicine, the evidence being based on the expert testimony of Dr. Nathan C. Keef, a graduate of both medicine and dentistry; the episode of international importance which occurred when a second secretary of the German Legation in Chile murdered a Chilean porter and absconded with a large sum of money; the exposé of the Russian woman Tschaikowski as a pretender to the perquisites of Anastasia, the youngest daughter of the last czar of Russia.

This book is interesting not only to the practitioner of dentistry but to the layman as well.

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A TEXTBOOK OF OPHTHALMOLOGY, by *Sanford R. Gifford, M.A., M.D., F.A.C.S., Formerly Professor of Ophthalmology, Northwestern University Medical School, Chicago.* 3d edition. 457 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1945. Price $4.

Dr. Gifford's last book, completed before his death, is excellently presented and carefully written. His style is clear and concise and practically every condition that the doctor with a wide general practice would encounter is discussed.

In the reviewer's opinion, the sections on refraction and injuries to the globe are exceptional. The color plates, especially the color photographs of actual disease processes are good, and it would have been more desirable had more of them replaced the black and white illustrations. The chapters on examination and ocular motility are probably too detailed for general use.

It is thought the author overemphasized the older therapeutic measures, particularly in regard to trachoma. Very little mention is made of sulfonamide therapy in any of the eye diseases and no reference to penicillin is given, which is regrettable but understandable if written prior to its introduction.

As a whole, medical officers, general practitioners, and especially industrial surgeons will find this book of definite value. The material can be found elsewhere, but nowhere is such a large subject presented in as an easy-to-read manner.

FUNDAMENTALS OF PHARMACOLOGY, by *Clinton H. Thienes, M.C., Ph.D., Professor and Head of the Department of Pharmacology, School of Medicine, University of Southern California.* 497 pages. Paul B. Hoeber, Inc., New York, publishers, 1945. Price $5.75.

This text, primarily written for medical students, can serve as a valuable reference for the practicing physician and pharmacist. Drugs referred to are grouped according to their physiologic action. A comprehensive index refers to each drug, which is briefly described, followed by the official preparations made from it, its dose, absorption, fate and excretion, local and systemic action, toxicology and its therapeutic use. An extensive bibliography at the end of each chapter refers the reader to many texts for more detailed study.

In addition to the well-written monographs on therapeutic agents, chapters on chemical diagnostic agents, actions of drugs on cells, and suggestions to prescription writers can aid the student materially. Nothing so endears the physician to the heart of the pharmacist, as the well-written prescription.

ESSENTIALS OF BODY MECHANICS IN HEALTH AND DISEASE, by *Joel E. Goldthwait, M.D., F.A.C.S., LL.D.; Lloyd T. Brown, M.D., F.A.C.S.; Loring T. Swaim, M.D.; and John G. Kuhns, M.D., F.A.C.S.;* with a chapter on the Heart and Circulation as Related to Body Mechanics, by *William J. Kerr,*

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M.D., F.A.C.P. 4th edition. 337 pages; 128 illustrations. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1945. Price $5.

For many years the authors have been interested in body mechanics or the effect of body posture on health and have expanded a series of lectures and articles into this small volume. Their long-standing interest is evidenced in the bibliography which is predominantly composed of articles appearing in the literature during the period 1910 to 1920. Similarly the clothing of the models depicted is that of the same era. It serves to remind us of the physician's age-long, difficult task in providing treatment and care of patients afflicted with chronic diseases. In fact its chief value would appear to be the emphasis it lays upon encouraging the sorely tried practitioner into continuing to endeavor further to bring some form of therapeutic aid to these unhappy people.

Muscular training, correction of faulty postural habits, and the application of apparatus such as splints and belts, are presented both for prophylaxis and treatment in cases of chronic arthritis and neuromuscular disorders. Nor is the range of chronic ailments treated by these methods confined to these. Tumors, diabetes, tuberculosis and many other chronic diseases are listed as being comforted and aided by these methods.

In fact were not the authors such prominent orthopedic surgeons lending the dignity of their positions in the surgical field to this thesis, one would be inclined to suspect that he were entering the shady sphere which lies between the physical culture enthusiasts and the chiropractors. To leave that impression would be unfair to the sincerity and the professional acumen of the authors, who have presented a book which should stimulate physicians to perform a better physical examination and to attain an understanding of the influences of body posture on the various systems of the body in health and disease.

DISINFECTION AND STERILIZATION, by *Ernest C. McCulloch, M.A., D.V.M., Ph.D., Professor of Bacteriology in the Health Research Institute, Professor of Bacteriology and Parasitology at the State College of Washington.* 2d edition; thoroughly revised. 472 pages; illustrated with 68 engravings. Lea & Febiger, Philadelphia, Pa., publishers, 1945. Price $6.50.

The second edition of this excellent reference work has been brought up to date by concise summaries concerning the application of recent discoveries such as those dealing with antibiotics such as penicillin. The outstanding feature of the book has been retained, namely, the concentration of pertinent technical information so that it is readily understandable by those concerned with sanitation and applied bacteriology.

Another merit of the work is that its content is based upon the outstanding discoveries of the past century. These may have been

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outstanding discoveries of the past century. These may have been made by Pasteur or by a modern researcher such as Fleming.

This text will prove of special value to medical officers concerned with sanitation. However it would be an asset as a ready reference for any commissary specialist or line officer responsible for sanitation aboard ship or at a shore station.

The diversity of subjects and the excellent list of selected references at the end of each chapter make this book valuable for inclusion in small reference libraries. A few of the many subjects discussed are: Sunlight as a natural agency; disinfection of the skin; surgical sterilization by heat; pasteurization; bacterial growth in frozen, canned and dehydrated foods; the relative value of disinfectants; water purification; sewage treatment; and the disinfection of air. Separate chapters are devoted to the disinfectants under the headings of halogens, phenols, dyes, metals, alkalies and acids. The relative merits and diverse uses of these numerous compounds are pointed out.

JOTTINGS FROM A CRUISE, by *Captain Alfred J. Green, Master Mariner.* Printed by The Kelly Printing Company, Inc., Seattle, Washington, 1944. Price, $3.50.

Jottings From A Cruise was written in diary and in letters, and now a half century later, is presented by the author's son.

Like Conrad, Captain Green commanded tall ships, loved the sea as a mistress, and wrote of his love. But his narrative style is rather that of Slocum, his depiction is of days asea and in port, of the vagaries, beauties and terrors of the deep.

"I think if you asked any man who in his youth had tried the sea for a voyage or two 'what were his pleasantest memories connected with life,' he would answer 'Sunday in the tropics, running down the trade winds.' There is such a perfect Sabbath peace and calm about everything——The ship glides along with a gentle measured motion through the blue shining waves. The air is soft, sensuous and balmy, with just enough freshness in the breeze to temper the glorious sunshine."

During the long stops in port, waiting to discharge or take on cargo, or as in Durban with a crew depleted by Transvaal gold-rush, the author is an excellent cicerone, his observations kind and philosophic.

This is not a sea classic, but it is a well-written tale of an enjoyed career, and a tribute to the almost vanished square-rigger.

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PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge

TOXIC EFFECTS OF ARSENICAL COMPOUNDS

AS EMPLOYED IN THE TREATMENT OF DISEASES IN THE UNITED STATES NAVY, 1944

OTTO L. BURTON
Captain (MC) U.S.N.
GEORGE W. JUSTYN
Chief Pharmacist U.S.N.
and
LAURA T. ANDERSON

From November 1924 until August 1942 medical officers of the Navy were required to make monthly reports of the number of doses of arsenicals administered and a separate report of each case in which ill effects were noted. Since August 1942 reports have been made quarterly, except from submarines. Beginning in 1945 reports are being submitted annually. During the 20 years, 1925 to 1944 inclusive, in which this information has been compiled, 2,555,994 doses of arsenicals have been administered and 1,281 untoward reactions have been reported.

Previous articles dealing with the information obtained from these reports have been published in the following issues of this BULLETIN:

September 1925	January 1935	January 1939	January 1943
January 1927	October 1935	October 1939	November 1943
January 1929	January 1936	January 1940	January 1944
July 1930	October 1936	October 1940	October 1944
October 1931	January 1937	January 1941	January 1945
October 1932	October 1937	October 1941	October 1945
October 1933	January 1938	January 1942	
October 1934	October 1938	October 1942	

Cases of arsenical dermatitis occurring during the year 1944 were reported in the October 1945 issue of the BULLETIN.

The present article includes all cases, except those of arsenical dermatitis, which were reported during the year 1944. Comparative figures from the experience of previous years are also presented.

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TABLE 1.—*Arsenical reactions, 1944*

Classification	Mapharsen and neoarsphenamine			
	Mild	Severe	Fatal	Total
Arsenical dermatitis*	10	16	0	26
Reactions of minor importance	16	0	0	16
Vasomotor phenomena	7	2	0	9
Liver damage	0	10	1	11
Toxic encephalopathy	0	0	2	2
Blood dyscrasia	0	0	1	1
Arsenical hypersensitivity	1	1	1	3
Acute renal damage	0	0	1	1
Hemorrhagic encephalitis	0	0	1	1
Circulatory collapse	0	0	1	1
Gastro-intestinal disturbances	3	0	0	3
Jarisch-Herxheimer reaction	4	0	0	4
Liver damage (doubtful reaction)	1	0	0	1
Febrile reaction	0	1	0	1
Total	42	30	8	80

* Case histories were published in the October 1945 issue of the BULLETIN. Sixty-seven of the above reactions (38 mild, 24 severe and 5 fatal) were caused by mapharsen. Thirteen (4 mild, 6 severe and 3 fatal) were caused by neoarsphenamine.

TABLE 2.—*Arsenicals administered during the year 1944 for all diseases*

Drug	Doses (grams)				
	0.9 to 3	0.9	0.6 to 0.9	Less than 0.6	Total
Bismarsen					
Navy	0	0	0	152	152
All others	0	0	0	38	38
Mapharsen					
Navy	0	0	0	355,310	355,310
All others	0	0	0	26,165	26,165
Neoarsphenamine					
Navy	0	1,175	8,113	1,882	11,170
All others	0	86	368	774	1,228
Sulfarsphenamine					
Navy	0	0	24	11	35
All others	0	0	0	19	19
Tryparsamide					
Navy	1,269	0	0	0	1,269
All others	758	0	0	0	758
Total	2,027	1,261	8,505	384,351	396,144

NUMBER OF PERSONS TREATED FOR SYPHILIS AND OTHER DISEASES

Annually, on 31 December, each activity reports to the Bureau of Medicine and Surgery, on NAVMED-Form A, the number of persons in that command who have a history of syphilis, and the number receiving any anti-syphilitic treatment during the year. A report of the number of persons who were treated during the year with an arsenical compound for a disease other than syphilis is also required. This census does not take into account persons who left the service during the year.

In table 7 treatment data are listed separately for "active ser-

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TABLE 3.—*Arsenicals administered during the 13-year period, 1932-1944, for all diseases*

Drug	Doses (grams)				
	0.9 to 3	0.9	0.6 to 0.9	Less than 0.6	Total
Acetarsone:					
Navy	0	0	0	166	166
All others	0	0	76	771	847
Arsphenamine:					
Navy	0	0	149	10,297	10,446
All others	0	0	7	706	713
Bismarsen					
Navy	0	0	0	2,820	2,820
All others	0	0	1	1,933	1,934
Mapharsen*					
Navy	0	0	0	931,090	931,090
All others	0	0	0	75,858	75,858
Neoarsphenamine					
Navy	0	7,954	321,409	388,970	718,333
All others	0	945	40,160	137,854	178,959
Silver arsphenamine					
Navy	0	0	0	355	355
All others	0	0	0	204	204
Sulfarsphenamine					
Navy	0	18	425	7,483	7,926
All others	0	8	404	13,530	13,942
Tryparsamide					
Navy	38,770	0	0	13	38,783
All others	18,686	0	2	8	18,696
Total	57,456	8,925	362,633	1,572,058	2,001,072

* First administered in 1935.

TABLE 4.—*Deaths and severe reactions following the administration of 1,392,838 doses of neoarsphenamine, 1925-1944; ratio of deaths and severe reactions to doses*

Classification	Deaths		Severe reactions		Deaths and severe reactions	
	Number	Ratio to doses, 1 to –	Number	Ratio to doses, 1 to –	Number	Ratio to doses, 1 to –
Hemorrhagic encephalitis	18	77,380	1	1,392,838	19	73,307
Arsenical dermatitis	13	107,141	214	6,509	227	6,136
Blood dyscrasias	9	154,759	20	69,642	29	48,029
Vasomotor phenomena	6	232,140	57	24,436	63	22,109
Acute renal damage	2	696,419	5	278,568	7	198,977
Acute yellow atrophy of the liver	2	696,419	0	.....	2	696,419
Vascular damage (probable renal hemorrhage)	1	1,392,838	0	.....	1	1,392,838
Liver damage	1	1,392,838	28	49,744	29	48,029
Jarisch-Herxheimer reaction	0	.....	2	696,419	2	696,419
Gastro-intestinal disturbances	0	.....	5	278,568	5	278,568
Polyneuritis	0	.....	1	1,392,838	1	1,392,838
Borderline hemorrhagic encephalitis	0	.....	1	1,392,838	1	1,392,838
Arsenical neuritis	0	.....	1	1,392,838	1	1,392,838
Optic neuritis	0	.....	1	1,392,838	1	1,392,838
Arsenical hypersensitivity	1	1,392,838	0	.....	1	1,392,838
Classification undetermined	1	1,392,838	0	.....	1	1,392,838
Total	54	25,793	336	4,145	390	3,571

vice personnel" and "all others." The term "all others" includes Veterans' Administration patients, dependents of Naval personnel, native populations of insular possessions, and prisoners of war.

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TABLE 5.—*Deaths and severe reactions following the administration of 1,006,951 doses of mapharsen, 1935-1944; ratio of deaths and severe reactions*

Classification	Deaths		Severe reactions		Deaths and severe reactions	
	Number	Ratio to doses 1 to –	Number	Ratio to doses 1 to –	Number	Ratio to doses 1 to –
Arsenical dermatitis	0	.....	37	27,215	37	27,215
Liver damage	1	1,006,951	19	52,997	20	50,348
Vasomotor phenomena	0	.....	3	335,650	3	335,650
Acute renal damage	1	1,006,951	0	.....	1	1,006,951
Toxic encephalopathy	2	503,475	0	.....	2	503,475
Blood dyscrasia	0	.....	1	1,006,951	1	1,006,951
Hemorrhagic encephalitis	1	1,006,951	0	.....	1	1,006,951
Polyneuritis	0	.....	1	1,006,951	1	1,006,951
Arsenical hypersensitivity	0	.....	1	1,006,951	1	1,006,951
Febrile reaction	0	.....	1	1,006,951	1	1,006,951
Circulatory collapse	1	1,006,951	0	.....	1	1,006,951
Total	6	167,825	63	15,983	69	14,593

TABLE 6.—*Deaths following administration of arsenical compounds, 1919-1944*

Year	Arsphenamine	Neoarsphenamine	Silver arsphenamine	Maparsen	Total	Year	Arsphenamine	Neoarsphenamine	Silver arsphenamine	Maparsen	Total
1919	3	0	0	0	3	1932	0	4	0	0	4
1920	1	1	0	0	2	1933	0	7	0	0	7
1921	3	1	0	0	4	1934	0	3	0	0	3
1922	0	4	0	0	4	1935	0	2	0	0	2
1923	0	1	0	0	1	1936	0	3	0	0	3
1924	1	2	0	0	3	1937	0	1	0	0	1
1925	0	2	0	0	2	1938	0	3	0	0	3
1926	0	4	0	0	4	1939	0	4	0	0	4
1927	1	4	0	0	5	1940	0	1	0	0	1
1928	0	6	0	0	6	1941	0	0	0	1	1
1929	0	3	0	0	3	1942	0	0	1	0	1
1930	0	3	0	0	3	1943	0	1	0	0	1
1931	0	0	0	0	0	1944	0	3	0	5	8
						Total	9	63	1	6	79

In table 7 it will be noted that 3,179 persons in the Navy and Marine Corps were treated with arsenical compounds during the year 1944 for diseases other than syphilis. These diseases were: Vincent's angina 2,526, Vincent's gingivitis 429, malaria 94, ulcers 15, acute tonsillitis 12, acne 10, chancroid 9, yaws 3, and other diseases and conditions eighty-one.

Of the persons in the group "all others" treated for diseases other than syphillis, 2,888 were treated for yaws, 45 for Vincent's angina and 1 for relapsing fever.

ARSENICAL HYPERSENSITIVITY

Case 27-1944.—This patient was exposed to infection on 1 December 1943, and reported to the sickbay on 5 February 1944 with sores on the face, legs,

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TABLE 7.—*Syphilis and arsenicals, U. S. Navy, 1944*

Item	Persons		
	Navy and Marine Corps	All others	Total
Syphilis census, 31 December 1944	24,287*	.....	24,287*
Number of persons treated for syphilis with:			
Arsenicals:			
Bismarsen	18	8	26
Mapharsen	10,027	3,174	13,201
Neoarsphenamine	546	60	606
Sulfarsphenamine	3	3	6
Tryparsamide	107	57	164
Total persons treated with arsenicals	10,701	3,302	14,003
Heavy metal compounds:			
Bismuth	9,854	1,962	11,816
Mercury	6	23	29
Potassium iodide	10	1	11
Total persons treated with heavy metal compounds	9,870	1,986	11,856
Number of persons treated for diseases other than syphilis with:			
Arsenicals:			
Bismarsen	2	0	2
Sulfarsphenamine	1	0	1
Mapharsen	1,944	1,970	3,914
Neoarsphenamine	1,182	964	2,146
Fowler's solution	50	0	50
Total persons treated with arsenicals	3,179	2,934	6,113
Heavy metal compounds:			
Bismuth	64	21	85

* Incomplete data.

arms, and penis. He was admitted with the diagnosis of gonococcus infection, urethra. The Kahn blood reaction was 4-plus, and the diagnosis was changed to syphilis.

Arsenical treatment was instituted with a 0.06-gm. injection of mapharsen on 11 February 1944, followed by 0.06-gm. injections on 15, 18, and 21 February and 4 March. Four hours after the last injection the patient complained of nausea, weakness, and headache. About 2 hours later he developed abdominal pain, fever, and chills. The temperature rose to 103.2° F., gradually returning to normal within 12 hours.

One gram of sodium thiosulfate was given intravenously, and recovery was complete in 2 days.

Case 28–1944.—After exposure to infection in August 1943, this patient reported for examination complaining of an ulcerated lesion on the penis, adjacent to the corona. A darkfield examination disclosed Treponema pallidum on 5 October, and the Kahn blood reaction was 4-plus on 19 November.

Arsenical treatment was begun with a 0.03-gm. injection of mapharsen on 23 November, followed by 0.06-gm. injections on 26 and 30 November and on 4 December. A reaction occurred immediately following the last injection, as manifested by headache, chills, pallor, dizziness, and a weak, irregular pulse. One cubic centimeter of epinephrine was given and the symptoms disappeared.

A 0.03-gm. injection of mapharsen administered on 10 December caused a similar reaction. The heart beat remained normal. A 0.012-gm. injection given on 14 January 1944 was followed in about 3 hours with chills, short-

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ness of breath, rapid heart action, and a mild frontal headache. The temperature reached 102.8° F., but returned to normal the following morning.

Treatment was changed to neoarsphenamine on 28 January. The patient received four injections, totaling 1.21 gm., with no ill effects, and recovery was complete in 32 days.

Case 29–1944.—After exposure to infection in March 1944, this patient noticed a pinhead-size lesion on the prepuce of the penis. Darkfield examinations revealed Treponema pallidum.

Arsenical treatment began with a 0.03-gm. injection of mapharsen on 25 May, and was followed by a 0.04-gm. injection on 28 May, and 0.06-gm. injections on 2 and 5 June. Ten minutes after the last injection the patient experienced chills, fever, and headache. Several hours later he experienced pain on swallowing. The pharynx and tonsils were seen to be moderately reddened; there were no follicles. The temperature was 101.8° Fahrenheit. The patient was given aspirin-phenacetin-caffeine capsules, 1 every 4 hours, and an icebag was applied to the throat. Recovery from this reaction occurred in 3 days.

One week later the patient was given a 0.03-gm. injection of marpharsen. Two hours later he had a frontal headache and a chill, the temperature rose to 100.2° F., the conjunctivae were diffusely injected, the tonsils were edematous and diffusely reddened, and the palate was soft.

The patient was admitted to the sick list and transferred to a base hospital for treatment and disposition. The time of recovery was not reported.

Case 30–1944.—This patient was exposed to infection on 21 and 27 January 1944. The first symptoms of syphilis were noted on 5 April. There was no evidence of a primary genital lesion; the primary lesion was probably on the right forefinger. Kahn blood tests yielded positive results on 7 April and 3 May.

Arsenical treatment began with 0.03-gm. injections of mapharsen on 13 and 15 April, which were followed by 0.06-gm. injections on 17, 19, and 21 April. Two hours after the last injection the patient had a chill and a severe febrile reaction. No gastro-intestinal symptoms or dermatitis were noted except for an erythema of the skin. The chills, fever, and erythema of the skin subsided after 24 hours (at times the temperature reached 105° F.), and recovery was complete in 3 days.

In the belief that this might be a protein reaction not associated with the drug, a 0.005-gm. injection of mapharsen was given intravenously on 25 May. A temperature of 102.4° F. and a slight chill followed within 2 hours. This second reaction was considered as definitely establishing a sensitivity to arsenicals, and the drug was discontinued. Recovery from the second reaction occurred in 12 hours.

VASOMOTOR PHENOMENA

MAPHARSEN

Case 31–1944.—The date of infection in this case is unknown. Syphilis was diagnosed by a typical maculopapular eruption of secondary syphilis and a 4-plus Kahn blood reaction.

Antiluetic therapy began with 0.04-gm. injections of mapharsen on 4, 8, and 11 September. On the day following the last injection the patient had a temperature of 103° F., and complained of headache, nausea, and a dull abdominal pain. Physical examination did not disclose any abnormalities except

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a mild tenderness beneath the right costal margin. The urine did not contain albumin or casts and there was no bile. Complete blood count was within normal limits. The icterus index was 13.5, and the blood urea 11.4 mg. per 100 cubic centimeters. The fever continued for 3 days.

This was not a typical arsenical reaction, although the drug was considered to be the most likely cause. One week later the patient was completely recovered, and it was decided to give him 0.02 gm. of mapharsen. Following this injection, the patient had a mild chill, a fever of 104.2° F., and a severe headache with photophobia and nausea. There was a pronounced conjunctivitis and some diffuse abdominal tenderness. Later he developed lethargy and a mild delirium. A urine specimen showed 0.22 mg. of arsenic per 100 cubic centimeters.

He was given 1 gm. of sodium thiosulfate and 1,000 cc. of 5-percent dextrose in saline solution intravenously and 1.75 cc. of 10-percent BAL in peanut oil intramuscularly every 4 hours for 4 doses, and then each morning for 2 more days. Response to treatment was prompt. The temperature became normal within 24 hours and there was no secondary rise. Recovery was complete in 3 days.

Case 32–1944.—After exposure to infection in May 1944, this patient developed a chancre on the prepuce of the penis. A darkfield examination showed Treponema pallidum and the Kahn blood reaction was 4-plus.

Arsenical treatment, begun with a 0.03-gm. injection of mapharsen on 22 July, was followed by 0.06-gm. injections on 24 and 28 July and on 1 and 4 August. Immediately after the last injection the patient developed a severe suboccipital headache, and within 4 hours there was onset of fever which reached 103° Fahrenheit. Anosmia was associated with the febrile response.

One week later he was given another 0.03-gm. injection of mapharsen which was followed in 8 hours by a fever of 100.8° Fahrenheit. Urinalysis showed no sugar or albumin, but 1 or 2 leukocytes and epithelial cells per high dry field. There were also uric acid crystals. Treatment consisted of bed rest, and the patient was transferred to a Naval hospital on 15 August.

Case 33–1944.—After exposure to infection on 31 March 1944, this patient developed a chancre on the penis. A diagnosis of syphilis was established by positive darkfield findings.

Arsenical treatment, begun with a 0.03-gm. injection of mapharsen on 4 April, was followed by 0.06-gm. injections on 6, 8, 11, 13, 15, and 18 April. Two hours after the last injection the patient experienced weakness and nausea and vomited. He was given an immediate infusion of 50-percent dextrose. His temperature rose to 104° F. and he had pain in the epigastrium and lumbar region. Fischer's solution, 500 cc., was given slowly by rectum. Two 1,000-cc. injections of 5-percent dextrose were administered intravenously, 4 hours apart, and recovery ensued in 2 days.

Case 34–1944.—The date of infection in this case is unknown. Infection was first noted when the patient was circumcised on 4 February 1943.

From 13 March 1943 to 23 May 1944, he received 44 injections of mapharsen, a total of 2.64 gm., and 32 injections of bismuth, a total of 3.51 grams. The last course of treatment began with a 0.04-gm. injection of mapharsen on 30 May, and 4 hours later the patient had generalized, moderately severe abdominal pain, nausea, and retching. There was no vomiting. Treatment consisted of morphine, ⅛ grain, sweetened liquids, bed rest, and codeine sulfate, ½ grain, every 6 hours. He recovered from the reaction in 2 days.

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Case 35–1944.—After exposure to infection on 2 February 1944, this patient developed a dorsal penile lesion. A darkfield examination on 30 March revealed numerous spirochetes morphologically resembling Treponema pallidum. A Kahn blood test was 4-plus.

From 31 March to 18 April he received 8 injections of mapharsen, a total of 0.45 gm., and from 31 March to 9 May he received 8 injections of bismuth, a total of 1.39 grams.

A second course of treatment began with a 0.06-gm. injection of mapharsen on 16 May, and 3 hours later the patient complained of headache, general malaise, and "chilly sensations." Examination revealed a temperature of 104° F., blood pressure 120/80, pulse rapid and bounding, and marked tremors of the extremities.

Treatment consisted of phenobarbital, ½ grain every 4 hours, bed rest, abundant fluids, and a liquid diet. He recovered in 3 days.

Case 36–1944.—A small lesion appeared on the frenum of the penis after this patient's exposure to infection on 17 August 1943. A darkfield examination showed Treponema pallidum.

From 6 September to 3 November, he received 10 injections of mapharsen, a total of 0.57 gm., and from 28 October to 30 December 10 injections of bismuth subsalicylate, a total of 1.3 grams. A second course of arsenical treatment began with a 0.03-gm. injection of mapharsen on 22 December, and was followed by 0.06-gm. injections on 29 December and on 1 January 1944. After each of these last 3 injections the patient experienced nausea and vomited several times. Blood counts and urinalysis were within normal limits. The patient was given a 0.02-gm. injection of mapharsen on 22 January with no further reaction, and was returned to duty with the recommendation that he receive 0.02- or 0.03-gm. doses of mapharsen and multiple vitamin tablets. Recovery was complete in 12 days.

Case 37–1944.—This patient was exposed to infection on 10 January 1944. On 25 January physical examination revealed a chancre under the foreskin. A darkfield examination showed Treponema pallidum. Results of Kahn and Kolmer blood tests were positive.

Arsenical treatment began with a 0.03-gm. injection of mapharsen on 29 January, and was followed by a 0.04-gm. injection on 1 February, a 0.05-gm. injection on 3 February, 0.06-gm. injections on 5 and 11 February, and a 0.001-gm. injection on 15 February. The 0.001-gm. injection was given after the administration of 0.2 cc. of epinephrine. Two hours after this injection the patient developed chills, fever, malaise, and vomiting. One thousand cubic centimeters of 5-percent dextrose was given intravenously. The patient recovered in 36 hours.

JARISCH-HERXHEIMER REACTION

MAPHARSEN

Case 38–1944.—This patient was exposed to infection on 15 October 1944 and 15 days later developed multiple chancres on the glans and the prepuce. Darkfield findings were positive for Treponema pallidum, but the results of Kahn blood tests were negative.

Arsenical treatment was instituted with a 0.04-gm. injection of mapharsen on 21 November, and 6 hours later the patient reported to the sickbay complaining of tenderness and soreness in the right groin. He was placed on the binnacle list and in about 8 hours there was moderate edema of the glans

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and prepuce and an increase in the size of the neighboring lymph node. About 19 hours after the injection the edema was greater and a second darkfield examination yielded positive findings. Within 2 days all edema had disappeared, and treatment was continued with no further reaction.

Case 39–1944.—Exposure occurred in August 1944 and the patient developed a primary lesion on the corona of the penis on 27 September. A darkfield examination showed Treponema pallidum on 30 September and a Kahn blood test was positive on 2 October.

Treatment was started with a 0.03-gm. injection of mapharsen and within 4 hours there was increased edema of the penile ulceration and an increase in the size of the inguinal bubo and a febrile reaction of 12 hours' duration. Treatment consisted of bed rest and administration of acetylsalicylic acid, grains 10, at the onset of the reaction, followed by morphine sulfate, ¼ grain. About 900 cc. of 5-percent dextrose in normal saline solution was given 16 hours after onset of the reaction. The patient recovered within 21 hours.

Case 40–1944.—The diagnosis of syphilis was substantiated in this case by positive Kahn blood reactions on 1 July, 9 August, 10 August, 22 August and 19 September 1944. The patient denied exposure or the appearance of any lesion. Treatment with mapharsen, neoarsphenamine, and bismuth was begun on 29 September. The third injection of mapharsen caused great pain and tenderness over both shins. The patient was very apprehensive and crying. There was considerable hyperesthesia of the skin over the tibia; examination showed no other pertinent findings. The three 0.06-gm. injections of mapharsen from 6 October to 3 November caused nausea, vomiting, and diarrhea. No laboratory analysis was made. Treatment consisted of corrective diet and bed rest, with nembutal medication. Two 0.2-gm. injections of bismuth were administered subcutaneously as concurrent treatment. Recovery from this reaction was complete in 52 days.

Case 41–1944.—After exposure of this patient in October 1944, a diagnosis of syphilis was made by the history of a primary chancre, positive Kahn blood reaction, and the presence of a typical secondary syphilitic lesion. Six hours after the first injection of 0.03 gm. of mapharsen, fever and other symptoms appeared, manifesting themselves as a Herxheimer's reaction. Two aspirin-phenacetin-caffeine tablets were given immediately, and recovery was complete in 12 hours.

GASTRO-INTESTINAL REACTION

MAPHARSEN

Case 42–1944.—After exposure to infection on 21 April 1944, this patient developed a penile lesion. A darkfield examination showed Treponema pallidum.

Arsenical treatment was begun with a 0.03-gm. injection of mapharsen on 25 May, followed by 0.06-gm. injections on 29 May and on 1, 5, 8, 12, 15, 19, and 22 June. Thirty minutes after the last injection the patient was troubled with considerable vomiting and pain in the abdomen, which continued throughout the day. During this time he had several loose bowel movements. The leukocyte count was 10,500. He was given a single oral dose of codeine sulfate, ½ grain, before admission to the sickbay, and a single dose of morphine sulfate, ⅛ grain, subcutaneously, after admission. Symptoms subsided and the patient was discharged to duty in 2 days.

Case 43–1944.—The patient noticed a small ulcer on the inside of the lip

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but stated that he did not know the cause. Local treatment of the ulcer was successful. Blood studies, including serodiagnosis, on 29 September 1944 indicated syphilis.

On 1 October darkfield examination showed no spirochetes having the typical morphology of Treponema pallidum. Kahn blood reactions were negative except on 14 November and this one was doubtful. Following a 0.02-gm. injection of mapharsen on 3 October, nausea, intermittent chills, edema of the face, and vomiting were noted. The temperature was 102.8° F., the pulse rate 96, and respirations 22 per minute. A 0.04-gm. injection of mapharsen, administered intramuscularly on 6 October, was followed by nausea and vomiting for 72 hours. The hemoglobin concentration was 88 percent, erythrocytes numbering 4,370,000, and leukocytes 10,200 per cu. mm. of blood, with 58 percent polymorphonuclears and 42 percent lymphocytes. Following the daily administration of 320,000 units of penicillin for 8 days, the patient was returned to duty on 14 December.

Case 44–1944.—Following exposure of this patient in October 1944, biopsy of a small lesion on 6 November revealed Treponema pallidum. The Kahn blood test was negative on 2 December. Treatment with mapharsen was started on 7 November. The third to eighth injections, given between 12 and 28 November, were followed in 1 hour by vomiting, except on two occasions when atropine sulfate, grain 1/150, was given 30 minutes before the mapharsen. On these two occasions vomiting occurred 2 or 3 hours after the mapharsen injection. The patient felt completely recovered within an hour after vomiting. No food was given for 8 or 10 hours preceding the injections. The urine was normal. The patient was transferred on 3 December to a Naval dispensary for further treatment.

FEBRILE REACTION

MAPHARSEN

Case 45–1944.—After exposure to infection in November 1944, this patient developed a lesion near the frenum of the penis. A darkfield examination showed Treponema pallidum and a Kahn blood reaction was 2-plus on 16 November.

Arsenical treatment was begun with a 0.04-gm. injection of mapharsen on 16 November, following which a fever reaction developed. The temperature rose to 102.5° F., returning to normal the following day. On 18 November the patient had no complaints, and 0.26 gm. of bismuth subsalicylate was injected intramuscularly. A complete blood count was within normal limits. Two days later it was noted that the patient appeared to have a slight sensitivity to mapharsen. Increasing doses of mapharsen were given, ranging from 0.01 gm. to 0.05 gm., in an attempt to desensitize the patient. On 24 November his temperature rose to 105° F. and the use of mapharsen was discontinued. The following day a leukocyte and differential count were within normal limits.

On 26 November the temperature was still 104° to 105° Fahrenheit. There was no evidence of encephalitis, jaundice, skin reaction, or blood dyscrasia. An infusion of sodium thiosulfate, 0.5 gm., was given with 1,000 cc. of 5-percent dextrose in normal saline solution. The urine was normal. Complete blood count showed 95 percent hemoglobin, 4,750,000 erythrocytes, and 16,750 leukocytes with a differential of 73 percent segmented cells, 20 percent lymphocytes, 2 percent band forms, 4 percent monocytes and 1 percent eosinophils.

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On 27 November the temperature was still elevated. No neurologic abnormalities were found. Sodium thiosulfate, 0.5 gm. was given by infusion, together with 1,000 cc. of 5-percent dextrose in normal saline solution. BAL ointment was massaged into the skin. The urine was normal. X-ray examination of the chest showed the lungs to be clear. On the following day the Kahn blood reaction was 2-plus. By 29 November the temperature, pulse rate and respirations were normal, and the penile lesion was nearly healed.

On 7 December erythema of the skin and a mild thermal reaction followed the administration of 0.01 gm. of mapharsen. On the following day the temperature, pulse rate, and respirations were normal, and the patient had no complaints.

On 19 December, in view of the severe thermal reaction on 24 November, and the skin erythema and mild thermal reaction following the injection of 0.01 gm. of mapharsen on 7 December, the patient was transferred to the hospital for further transfer to a Naval hospital in the continental United States, with the recommendation that injections of bismuth subsalicylate be continued in the interim.

LIVER DAMAGE

MAPHARSEN

Case 46–1944.—After exposure to infection on 16 October 1943, this patient developed an indurated lesion at the coronal sulcus of the penis; the lesion was covered with a thin pink membrane. A darkfield examination showed Treponema pallidum. A Kahn blood test was 4-plus.

From 23 November 1943 to 20 October 1944, the patient received 23 injections of mapharsen, a total of 1.87 grams.

Immediately after the 0.06-gm. injection of mapharsen on 20 October, the patient experienced dizziness, weakness, nausea, and loss of appetite, and perspired profusely. Examination showed the skin to be warm and moist, and there were petechial hemorrhages of both conjunctivae. The total intake of fluids was 4,720 cc. and total output 1,624 cubic centimeters. Five-percent dextrose, 2,000 cc., was given intravenously. The urine was normal. Two days later the patient complained of headache, nausea, and lassitude, and on the following day an infusion of 1,000 cc. of 5-percent dextrose was given. The total fluid intake was 3,785 cc. and total output 2,424 cubic centimeters. The urine was normal.

On 31 October, after the patient had vomited once daily for the preceding 6 days and was unable to retain fluids, examination showed slight jaundice of the skin and sclera, and some tenderness over the liver. The liver was not palpable at the costal margin. An infusion of 5-percent dextrose in 1,000 cc. of normal saline solution was administered.

By 1 November the patient had no complaints, and the jaundice and tenderness over the liver were disappearing. The urine contained no occult blood. The patient was placed on a routine diet and experienced no further nausea or vomiting. Recovery was complete in 22 days.

Case 47–1944.—This patient reported to the sickbay on 20 July 1944 complaining of three sores on the corona of the penis. Results of darkfield examinations were negative for Treponema pallidum, and Kahn blood tests were negative on 31 July and 7 August. The lesions were treated locally. On 17 September a Kahn blood test was 4-plus, and subsequent Kahn blood tests on 25 September and 9 October were 4-plus.

Arsenical treatment was instituted with a 0.06-gm. injection of mapharsen

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on 22 September, and 6 days after the injection the patient appeared at the sickbay stating that he felt nauseated. The sclera, skin, and mucous membranes were markedly icteric. He appeared to be ill, vomited a few times, and was unable to take food. He was admitted to the sick list and given intravenous dextrose and general supportive treatment.

On 2 October the patient still felt nauseated and weak but was able to take food by mouth without difficulty. Treatment was continued with bismuth subsalicylate. The patient remained jaundiced and on 18 October he was transferred to another ship for further transfer to a Naval hospital for treatment and disposition.

Case 48–1944.—This patient was exposed to infection on 8 August 1944, and following positive darkfield findings, arsenical treatment was begun on 17 October with a 0.03-gm. injection of mapharsen followed by 0.06-gm. injections on 21, 24, 28, and 31 October and 4 November. Forty-eight hours after the last injection the patient became jaundiced. Since antisyphilitic treatment was begun he had lost 10 pounds. All medications were stopped and the patient was placed on a high carbohydrate diet. The icterus index was 25 on two occasions. Recovery occurred in 14 days.

Case 49–1944.—After exposure to infection in June 1944, this patient developed an intra-meatal primary lesion. A darkfield examination showed Treponema pallidum, and a Kahn blood test was 4-plus on 9 August.

Antiluetic treatment began with a 0.03-gm. injection of mapharsen on 9 August, and was followed by 0.06-gm. injections on 12, 15, 19, and 23 August. A reaction followed the last injection and treatment with arsenicals was discontinued until 4 September, when he was given a 0.015-gm. injection of mapharsen. A reaction occurred and he was admitted to the sick list with a diagnosis of poisoning, therapeutic, mapharsen, syphilis. He complained of weakness, nausea, and aching of the muscles of his arms and legs. These symptoms subsided and he was returned to duty in 5 days.

He was readmitted to the sick list on 13 August, complaining of general weakness, jaundice, loss of weight, shooting pains in the arms, some blurred vision involving the left eye, and itching of the skin. Physical examination revealed tenderness over the liver on inspiration, loss of weight (about 20 pounds), jaundice, and mild anemia. The hemoglobin concentration was 62 percent, the erythrocyte count was 3,400,000, and the leukocyte count 6,300. The urine contained bile. He received 5 injections of sodium thiosulfate, and 1,000 cc. of saline and dextrose intravenously, and a high protein, high carbohydrate diet with multiple vitamins was given, together with ferrous sulfate and complete bed rest. Improvement was noted but progress was very slow, and the patient was transferred on 26 August to a dispensary at an outlying station for further treatment and disposition.

Case 50–1944.—After several exposures to infection this patient developed an indurated ulcer on the shaft of the penis on 24 May 1944. Darkfield examination was positive for Treponema pallidum. Arsenical treatment began with a 0.06-gm. injection of mapharsen on 9 June, followed by 0.06-gm. injections on 12, 14, and 16 June.

On the evening of 16 June the patient had a mild chill and his temperature rose to 103° Fahrenheit. There was nausea and vomiting and he complained of sore throat. The following morning there was pronounced generalized erythema of the skin, and the temperature rose to 104° Fahrenheit.

On the third day of the reaction a toxic nephritis was indicated by the presence of albumin and casts in the urine. Two days later a toxic hepatitis was

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indicated by the onset of jaundice and the presence of bile in the urine. There was an immediate direct van den Bergh reaction. The indirect test yielded 3.75 milligrams of bilirubin per 100 cc. of serum. The icterus index reached a peak of 75 before the jaundice started to clear.

Treatment consisted of bed rest, daily infusions of dextrose in normal saline solution, sodium thiosulfate, 1 gm. intravenously each day for 4 days, and a liquid high carbohydrate diet during the early acute phase of the illness, followed by a soft high carbohydrate diet. The patient's condition steadily improved and by 14 July he was well on the road to recovery.

Case 51–1944.—This patient was exposed to infection on 4 March 1944, and developed an excoriation on the penis which healed in 4 days. A diagnosis of syphilis was made on the basis of a positive Kahn blood reaction.

Arsenical treatment began with a 0.03-gm. injection of mapharsen on 31 March and was followed by a 0.04-gm. injection on 3 April, and 0.06-gm. injections on 7, 10, 14, and 17 April. Nausea and malaise followed the injections given on 10 and 14 April. Vitamin C, 200 milligrams, was administered daily. After the mapharsen injection on 17 April the temperature rose to 101.2° Fahrenheit. The eyes were injected and irritated, and clinical jaundice was noted. The icteric index was 78 on 1 May. He was given 1,000 cc. of 5-percent dextrose intravenously each day for 9 days, and a high carbohydrate diet was prescribed. Recovery from the reaction was complete in 11 days.

Case 52–1944.—This patient was admitted with extensive secondary lesions of syphilis (alopecia, adenopathy, and mucous patches), with the primary lesion on the upper lip. The primary lesion was first noted on 14 October 1944 and routine therapy was begun immediately. The patient had intercurrent scarlet fever. After receiving 7 mapharsen and 4 bismuth injections, he became intensely jaundiced on 1 November. Treatment with penicillin was started with no ill effects. Because of the amount of arsenical treatment given, and the variety of jaundice in scarlet fever, the reaction is considered to be one of acute hepatitis due to arsenicals.

After the patient had been receiving dextrose infusions and a high protein, high carbohydrate, low fat diet with vitamin supplements for 8 weeks, the icterus index was still about twenty. The urine contained bile, and icterus was visible, though slight.

Case 53–1944.—This patient was received on board for duty on 23 November 1944. He was receiving the 26-week course of anti-syphilitic treatment and this routine was continued. On 16 December, after receiving 15 mapharsen and 5 bismuth injections, the patient was admitted with what appeared to be typical catarrhal fever. These symptoms subsided on 18 December.

On 22 December he was readmitted with symptoms of malaise, generalized aches, and pains. Later he developed jaundice, presumably due to mapharsen, the last dose of which was 0.06 gm. administered on 18 December. The patient responded well to a high carbohydrate diet and supportive treatment, and is expected to resume his duties in the near future.

Case 54–1944.—This patient suffered an acute attack of poisoning following 5 injections of 0.06 gm. of mapharsen. Injections were given over a 2½-week period. Symptoms consisted of severe abdominal pain, nausea and vomiting, sore throat, low-grade fever, and jaundice. Laboratory examination showed a white blood cell count of 30,000 with a shift to the left, albuminuria, acholic stools, and bilirubinuria. Treatment consisted of abundant fluids, high carbohydrate–low fat diet, and intravenous fluids and dextrose.

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LIVER DAMAGE (DOUBTFUL REACTION)

Case 55–1944.—After exposure to infection in July 1944, this patient developed a penile chancre, a biopsy of which was positive for Treponema pallidum on 11 October. The Kahn blood reaction was negative on 20 October.

Four days after the sixth injection of 0.06 gm. of mapharsen the patient developed slight jaundice which caused no subjective symptoms. Physical examination showed no abnormalities; no lesions were noted on the genitals. Treatment consisted of bed rest and a regular diet, and recovery ensued in 7 days.

LIVER DAMAGE

NEOARSPHENAMINE

Case 56–1944.—After exposure in October 1944, a diagnosis of syphilis was established on 13 November by darkfield examination of a specimen from a penile lesion, and a 0.45-gm. injection of neoarsphenamine was given. A 0.6-gm. injection of neoarsphenamine on 16 November was followed by slight abdominal cramps lasting approximately 30 minutes. There was no vomiting or diarrhea.

On 20 November, another 0.6-gm. injection of neoarsphenamine was followed by severe gastro-intestinal cramps, nausea, vomiting, and diarrhea, with abdominal rigidity and a fever of 104.2° Fahrenheit. Treatment consisted of intravenous fluids and bed rest. A 0.06-gm. injection of mapharsen on 1 December occasioned no symptoms or signs of an untoward reaction. On 5 December a 0.06-gm. injection of mapharsen was given and was followed by moderate abdominal cramps with recurrence of fever (101.4° F.). Treatment consisted of abundant fluids and discontinuance of all arsenicals. Three days later 1 cc. of bismuth subsalicylate was administered, with no reaction. The temperature, however, had not returned to normal. On 19 December there was a visible icteric tint to the sclera, and liver tenderness. The patient was not receiving any medication. He was transferred to a Naval hospital.

FATAL REACTIONS

MAPHARSEN

Case 57–1944.—This patient (a supernumerary, U. S. Army) was admitted with a large lesion on the dorsum of the penis and a generalized macular rash. The dates of the patient's exposure to infection and appearance of the initial lesion are unknown. Darkfield examinations yielded negative findings but a Kahn blood test was 4-plus.

Arsenical treatment began with a 0.04-gm. injection of mapharsen on 5 December 1944, and was followed by 0.06-gm. injections on 8, 12, and 15 December.

One hour after the last injection the patient complained of weakness, vertigo, and blurred vision. At that time the radial pulse was not palpable, the blood pressure was 50/0, and the heart sounds could be heard only faintly and only at the base.

Treatment was begun to combat the evident circulatory collapse, and during the day he was given epinephrine hydrochloride, 1:1,000 solution, 1 cc. subcutaneously; caffeine with sodium benzoate, 7½ grains orally; 5-percent dextrose in normal saline solution, 1,000 cc. intravenously; and 500 cc. of blood plasma. His condition became progressively worse, cyanosis was soon evident,

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convulsions of a clonic type occurred, respirations became rapid and labored, and he died at 2025 on 15 December.

Case 58–1944.—After exposure to infection on 17 March 1944, this patient developed an indurated coronal ulcer on the penis. Darkfield examination showed Treponema pallidum. A Kahn blood reaction was positive on 17 April. From 17 April until 20 May he received nine 0.06-gm. injections of mapharsen, a total of 0.54 gram.

At 0800 on 24 May, 4 days after the last injection, he was admitted to the medical ward with a history of extreme weakness and gradually increasing shortness of breath. The pulse was 110, blood pressure 80/50, and he was in shock. There was definite air hunger, and Kussmaul's type of respiration with a rate of 50 per minute. The tongue and skin were dry. The heart and lungs were normal. The abdomen was moderately scaphoid and rigid throughout. There was a moderate acetone odor to the breath. Blood sugar determination revealed 200 milligrams per 100 cubic centimeters. He could swallow liquids but could not be aroused sufficiently to answer questions.

Small amounts of water and fruit juice were administered by mouth frequently, and he was given 3,000 cc. of 5-percent dextrose in normal saline solution and 60 units of insulin intravenously during the afternoon and evening of 24 May. The immediate response was good. The blood pressure rose to 100/70, the pulse rate dropped to 96, and the respirations decreased to 36 per minute. He maintained this evidence of improvement until 1000 on 25 May, when he again suddenly lapsed into severe shock. The blood pressure fell to 60/40, the pulse rate increased to 120 beats per minute, and in spite of administration of caffeine sodium benzoate and attempts to administer dextrose in saline solution intravenously, he expired at 1100 on 25 May.

Necropsy showed acute gastric dilatation, marked fatty change of the liver, congestion of the kidneys, early edema of the lower lobe of the right lung, and seropositive lues. Death was considered to have resulted from an acute degeneration of the liver in association with gastric dilatation, and resulting shock.

Case 59–1944.—This patient was admitted to the sick list on 20 July 1944 with a history of exposure to infection several weeks previously. Physical examination revealed a coronal penile chancre and suprapubic chancre, both yielding positive darkfield findings. There was a typical copper-colored macular secondary rash of several days' duration over the chest and abdomen. There were no other abnormalities. The blood and urine were normal except for a 4-plus Kahn blood reaction.

The 5-day treatment with mapharsen was begun on 22 July. There was the usual amount of nausea, slight vomiting, headache, and fever, but otherwise the patient's course was uneventful. The temperature rose to 100.6° F. on the first day but remained normal thereafter until the fifth day, when it rose to 100° Fahrenheit. The pulse rate and respirations remained essentially normal except for slight rises coincident with the fever. Daily icterus index reading and urinalysis showed normal findings. Spinal fluid examination on the morning after the last day of treatment showed it to be normal.

At 0745 on 29 July, approximately 36 hours after completion of the 5-day treatment, the patient suddenly collapsed in convulsions while in the head. During the next 8 hours he was in deep coma, interspersed with brief episodes of violent tonic and clonic convulsions. Rigidity was marked and respirations were rapid and stertorous, with gradually increasing pulmonary edema. The spinal fluid examination 4 hours after onset of coma showed an

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initial pressure of 300 millimeters. The patient remained comatose, the respirations became labored, and he expired at 1540 on 29 July.

Chemical analysis of the brain tissue revealed the presence of 0.24 milligrams of arsenic per 100 grams. Necropsy findings included syphilis with chancre, pubic (initially positive for Treponema pallidum); encephalosis, toxic (arsenical therapy); tracheobronchitis, acute; hepatitis; cloudy swelling and congestion of the kidneys and pancreas; and atherosclerosis, early, of the coronary artery.

Case 60–1944.—This patient was admitted to the sick list on 4 September complaining of sores on the penis. Exposure to infection occurred 8 weeks prior to admission, and the sore on the penis developed 5 days before admission. He had had gonorrhea 4 months previously which was controlled by penicillin. The past medical history was otherwise unimportant, as were the family history and a review of the systems. A darkfield examination showed Treponema pallidum. The urine and blood were normal, and the Kahn blood test was negative.

On 9 September a 0.09-gm. injection of mapharsen was given by constant intravenous drip, in 1,000 cc. of 5-percent dextrose in normal saline solution. Because of considerable nausea, the full dose of 0.24 gm. was not given. On 10 and 11 September the full dose of 0.24 gm. was given each day. The total dose received on the third day amounted to 0.57 gm., less than one-half the customary total dose for the 5-day treatment.

Following the third injection there was more than ordinary nausea on the first day and a mild persistent discomfort in the left upper quadrant of the abdomen. No abnormality was detected on physical examination. The highest temperature recorded during the 3 days of the reaction was 102° F., the maximum pulse rate 96, and fastest respirations 30 per minute. The icterus index was 15 at the beginning of treatment and 12.5 on the third day.

At 2400 on 13 September the night hospital corpsman reported the patient sleeping quietly. Fifteen minutes later the patient had a tonic convulsion and went into a moderately deep coma, with slight response to painful stimuli. He was incontinent, respirations were stertorous, and there were intermittent convulsions.

Treatment consisted of placing the patient in an oxygen tent; trachea aspirations; mouth gag; sedatives (sodium luminal, grains 6 at 0130 and grains 3 at 2130 intravenously), atropine, grain 1/75 at 0145 and grain 1/100 at 0930; sodium thiosulfate, 0.5 gm. at 1100 and 1430; and 1,000 cc. of 5-percent dextrose in distilled water, begun at 1330. At no time was there any improvement in the patient's condition. The temperature fluctuated between 102° and 103° F. from the onset of convulsions. There was gradually increasing pulmonary edema, and death occurred at 0445 on 14 September.

Necropsy findings were poisoning, arsenical, therapeutic (5-day treatment); edema, cerebral, generalized; diffuse capillary hemorrhagic infiltration in the pons, with degeneration; focal necrosis, bilateral at the calcar avis; antemortem rupture of the stomach and diaphragm, with digestive changes; apparent multiple hemorrhages, pulmonary, bilateral; and evidence of toxic splenitis.

Case 61–1944.—After exposure to infection on 21 October 1944, this patient developed multiple chancres about the corona of the penis. There was a thick, yellow, gonorrheal discharge. Darkfield examination of specimens from the lesions showed Treponema pallidum.

From 30 October to 20 November the patient received 6 injections of neoarsphenamine, a total of 3.3 gm., and on 23 and 27 November he received

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0.06-gm. injections of mapharsen. Three days after the last injection he complained of an itching eruption of the skin. Physical examination showed no evidence of hemorrhage in any mucosa, the throat appeared clear, the chest and heart were normal, and examination of the abdomen did not show any abnormality. There was a psoriatic type of nonscaly rash over the antecubital fossae and the axillae, the neck, the thighs, around the mid-trunk, and over the popliteal spaces.

On 13 December the temperature rose to 103° F., and the patient had a slight cold and cough. The inguinal glands were swollen and tender. On 14 December there were scattered vesicles over the lower leg, some of which were broken. On the following day he was transferrd to a Naval hospital.

On admission to the hospital the patient showed slight puffiness of the skin under the eyes and moderate edema of the ankles. There was a short systolic mitral murmur, not transmitted, bilateral tender inguinal adenopathy, and a dry, scaly, papular, psoriatic type of eruption over the entire body except for the face, palms, and soles. The eruption was most profuse over the back, lower trunk, and legs. On the lower legs the lesions were vesicular and weeping, and there were several small pustules just above the ankles.

On 16 December a urine test for heavy metals was negative. The hemoglobin concentration was 84 percent, the erythrocyte count 4,070,000, and the leukocyte count 20,000, with 27 percent eosinophils and 54 percent neutrophils. Four days later the hemoglobin concentration was 68 percent, and the leukocyte count was 17,800, with 36 percent eosinophils. The nonprotein nitrogen was 63.2 percent and chlorides 4.95 milligrams per 100 cc. of blood. Urinalysis showed 10 milligrams of albumin and a specific gravity of 1.015.

On 22 December the blood pressure was 138/60. A course of BAL was completed. Intake of fluids was 2,280 cc. and output 1,560 cubic centimeters. The face appeared slightly puffy and moist râles could be heard in the bases of both lungs posteriorly; the patient had a slight cough, and there was some distention of the abdomen. The temperature was 102° Fahrenheit. The erythrocyte count was 3,800,000 and the leukocyte count 15,650, with 58 percent neutrophils and 25 percent eosinophils. On the following day the fluid intake was 2,400 cc. and the output 480 cubic centimeters. The highest temperature was 101° Fahrenheit. There was albuminuria of over 100 milligrams.

On 24 December râles were still present, although no definite signs of consolidation could be elicited. The eyes were puffy, the ankles edematous, and the abdomen was distended. Albuminuria, hematuria, and cylindruria were present. The patient had some difficulty in breathing. The next day the patient was still dyspneic. The pulse rate was 120 and respirations were 36 per minute. The blood pressure was 160/100. There was fluid in the abdomen and left lung. Fluid intake was restricted to 2,000 cc.; the output was 840 cubic centimeters. The leukocytes in the blood numbered 26,400 per cu. mm. with 74 percent polymorphonuclear leukocytes and 9 percent eosinophils; the erythrocytes numbered 2,930,000 per cubic millimeter. The hematocrit reading was 30 percent.

On 26 December the general condition was unchanged. There was some dyspnea and wheezing and moist râles could be heard throughout the chest. The patient was placed in an oxygen tent, and given an infusion of 25 cc. of 50-percent dextrose in saline solution. Penicillin therapy was started, 20,000 units every 3 hours. The blood pressure was 168/108. Blood sugar was 60.7 milligrams and the nonprotein nitrogen 76.4 milligrams percent. The urine contained albumin, pus, red blood cells, and casts. The output was 700 cubic centimeters. On 27 December the skin was in fairly good condition.

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Edema was still present. Ammonium chloride, grains 15, was administered every 4 hours, and a transfusion of 500 cc. of whole blood was given. The blood pressure dropped to 140/90. The total serum protein was 5.4 grams percent. Urinary output was 520 cubic centimeters.

The following day the patient became extremely dyspneic, complained of pain in the chest, and coughed up small amounts of bright red blood, after which he appeared moribund. Medical consultation interpreted this to be a possible pulmonary infarction. He was given 3 units of plasma slowly, and aminophylline, grains 3, after which his condition improved. On the following day 500 cc. of whole blood was administered. The patient vomited about 200 cc. of green liquid. The nonprotein nitrogen was 153.6 milligrams and the blood chlorides 462 milligrams. Total protein was 6.0 milligrams. On 30 December he was given 500 cc. of plasma, and the leukocyte count was 31,400 with 79 percent neutrophils and 5 percent eosinophils. The patient suddenly became dyspneic and expired.

Autopsy findings.—The subject was a young Negro with generalized anasarca. The tissues when sectioned were found to be waterlogged. Both pleural cavities contained about 1 quart of serous fluid. The pericardium contained about 150 cc. of straw-colored fluid and the peritoneal cavity about 1 gallon of similar fluid. The heart was of normal size; the myocardium was pale and cloudy. The trachea and bronchi were filled with frothy edematous fluid. The lungs were moist and heavy, and there were patchy areas of consolidation throughout the lower lobes. The liver was enlarged, weighing 1,900 gm., and had a "nutmeg" appearance, with pale, swollen lobules containing red, congested centers. The kidneys were enlarged and bulged from the capsules; their combined weight was 450 grams. The cortex was pale yellow, and swollen, with markings obscured. The spleen was slightly enlarged, weighing 200 gm., red and swollen, with prominent lymphoid follices. The marrow of the femurs was pale yellow; the sternal marrow was pale pink and hypoplastic. The diagnosis was pulmonary congestion and edema, bilateral hydrothorax, hydropericardium and hydroperitoneum, generalized anasarca, acute tubular nephritis, acute degenerative hepatitis, acute degenerative myocarditis, and hypoplasia of the bone marrow.

FATAL REACTIONS

NEOARSPHENAMINE

Case 62–1944.—One month after exposure to infection on 28 August 1944, this patient developed a small punched-out lesion on the dorsum of the corona of the penis. A darkfield examination showed Treponema pallidum. A Kahn blood test was 4-plus.

Arsenical treatment began with a 0.3-gm. injection of neoarsphenamine on 6 October, followed by 0.6-gm. injections on 10, 13, 17, 20, 24, and 27 October. Four days after the last injection the patient's skin was flushed and there was a generalized scarlatiniform rash. He complained of increasing soreness of the throat, and aching teeth and gums. The throat was diffusely reddened, punctate, and there was a small macule-like mucous patch on the soft palate. The temperature was 103° Fahrenheit. The patient was placed in isolation and arsenic therapy was discontinued. The condition was believed to be either an arsenic reaction, possibly a secondary syphilis, or scarlet fever. Blood count showed relative leukopenia with agranulocytosis. There was no palpable liver or right abdominal quadrant tenderness, and no icterus.

The patient was transferred to a Naval hospital on 1 November, where

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he developed a generalized exfoliative dermatitis, stomatitis, and neutropenia. Despite all treatment, including penicillin and whole blood transfusions, his condition became progressively worse and he expired on 18 November.

Autopsy findings.—The subject was emaciated; the body length was 71 inches, the weight 160 pounds. The skin was erythematous and covered everywhere with scales. There were several posterior decubitus ulcers and hemorrhagic infiltrations in the right conjunctiva. The intestines were distended with gas. The brain showed evidence of congestion and edema. The heart had small hemorrhagic areas in the aortic valve; the myocardium was pale and flabby. The liver was enlarged and revealed the central degeneration indicative of arsenical poisoning. The kidneys were large, swollen, and nephrotic. The spleen was large, flabby and "septic." The abdominal lymph nodes were enlarged and watery. The bone marrow of the sternum and femur was pale and hypoplastic. The lungs showed evidence of congestion and edema and there was slight bilateral hydrothorax, about 300 cc. of fluid in each pleural cavity. The peritoneum contained approximately 1,000 cc. of fluid. The aorta showed a widespread atheromatosis with some suggestion of medial swelling.

The findings included, in summary, multiple petechial hemorrhages of epicardium, pleura, and conjunctiva; acute toxic hepatitis; acute degenerative nephrosis; cerebral congestion and edema; pulmonary congestion and edema; bilateral hydrothorax; hydroperitoneum; splenic tumor; hypoplasia of bone marrow; acute aortitis; and acute myocardial degeneration.

Case 63–1944.—This patient was admitted to the sick list on 6 September 1944, complaining of tender, sore, bleeding gums of 1 week's duration. Physical examination revealed numerous tender, painful ulcers on the gums, which bled easily. A diagnosis of Vincent's angina was made.

Treatment consisted of sodium perborate mouthwash every 2 hours and intravenous injections of neoarsphenamine. The patient received 0.3-gm. injections of neoarsphenamine on 6 and 8 September and a 0.6-gm. injection on 10 September. In the evening after the last injection the patient complained of an occipital headache. On the following day his temperature rose to 101.5° F. and his headache became worse. Examination disclosed no pertinent findings and it was considered that the patient was experiencing a mild reaction to neoarsphenamine.

On the morning of 12 September he developed a moderate degree of photophobia and became quite irritable. Any noise seemed to excite him and he would cover his ears with his hands when spoken to. He still had an occipital headache and the temperature was constantly elevated (100.4° to 101.5° F.). Toward evening he seemed to be in a mildly toxic condition and complained of nausea. He also seemed to have considerable difficulty in hearing. At 1030 on 13 September he became semicomatose. He responded to pain stimuli but not to visual or auditory stimuli. He was given 1,000 cc. of 10-percent dextrose in normal saline solution and seemed to improve.

At 0900 on the following day he had a major convulsive seizure lasting about 30 seconds. At 0945 he went into a toxic state, with clonic seizures occurring every 5 to 10 minutes and lasting 1½ to 2 minutes. Any disturbance would start a typical grand mal type of seizure. He was given 7½ grains of sodium pentobarbital intramuscularly, and because of the intense cyanosis present was placed in an oxygen tent. After intravenous injection of 500 cc. of 50-percent dextrose in saline solution his color and breathing improved. The arsenical detoxifying agent, BAL, was flown in by plane and 3 cc. of 5-percent solution was given every 4 hours for 4 doses. For the next 24 hours

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the patient's condition became progressively worse and he expired at 1030 on 14 September. Necropsy showed hemorrhagic encephalitis.

Case 64–1944.—The date of infection in this case is unknown. The patient had reported to the sickbay in 1939 with a skin rash. A Kahn blood test done at this time was 4-plus, and a diagnosis of syphilis, seropositive only, was made. There was no history of a primary lesion and no scar of a primary lesion was found. Several Kahn blood tests were done over a period of 4 years, in all of which there were positive reactions.

From 16 August 1939 to 11 March 1943, this patient received intermittent treatment with 8 injections of neoarsphenamine and 44 injections of mapharsen. In August 1943 his spinal fluid was positive for syphilis. From 19 December 1943 to 11 January 1944, he received four 0.9-gm. injections of neoarsphenamine and four 0.13-gm. injections of bismuth.

Two days after the last injection of neoarsphenamine the patient fell out of his bunk and was brought to the sickbay on a stretcher. He stated that he had felt nauseated several hours after the last treatment, but had thought nothing of it because this had occurred after several previous treatments and the nausea usually passed away in a few hours. He vomited several times. He also had some aching of the arms and legs. The temperature was 100° F., the skin and lips were dry, and the tongue seemed slightly dry; the pulse rate was 68, and respirations were 18 per minute. No other abnormalities were found on physical examination.

The patient was rational. He drank 300 cc. of water and was given phenobarbital, grain ½, by mouth. He went to sleep in about an hour. At 0130 and 0230 on 14 January the patient was seen by a hospital corpsman and appeared to be sleeping normally. At 0430 another patient heard him breathing quietly and he believed normally. At 0715 he was found dead. The body was packed in ice until arrival in port and transferred to a Naval hospital for autopsy and burial. Necropsy showed many small regions of necrosis and hemorrhagic infiltration in the cerebellar cortex, and a few in sections of the midbrain.

The toxicologic report indicated 1.5 mg. of arsenic in 100 gm. of liver tissue. This would be compatible with death from hypersensitivity during arsenic therapy, and would not indicate erroneous dosage. The necropsy findings are interpreted as those of encephalitis due to arsphenamine hypersensitivity.

REACTIONS OF MINOR IMPORTANCE

NEOARSPHENAMINE

Case 65–1944.—After exposure to infection on 15 February 1944 this patient developed 2 shallow, slightly indurated ulcers about 2 cm. in diameter on the dorsal aspect of the corona of the penis. Darkfield examination showed Treponema pallidum.

Arsenical treatment began with a 0.03-gm. injection of mapharsen on 31 March and was followed by a 0.6-gm. injection of neoarsphenamine on 17 April. One hour after the last injection the patient had a headache, chills, and fever. Three hours after the injection he vomited and appeared acutely ill. The temperature was 102° Fahrenheit. Sodium thiosulfate, 0.5 gm. daily, was administered for 4 days, after which he became symptom free, and was fully recovered in 4 days.

Case 66–1944.—This patient developed shallow, somewhat painful ulcerations on both sides of and under the tongue, extending onto the gums and

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buccal mucosa posteriorly. For 4 months a variety of medication was tried, including 10-percent silver nitrate, sulfathiazole powder, multivitamins, bismuth subsalicylate, and a mouthwash, all without effect. The lesions were considered to be suggestive of moniliasis, and were painted with gentian violet solution for 2 weeks without results. Then the treatment was changed to local applications of 7-percent chromic acid, followed by mapharsen powder twice daily and neoarsphenamine, 0.6 gm., intravenously. Following this the patient developed chill, fever, vomiting, and generalized aching. These symtoms subsided after 72 hours. A second injection of neoarsphenamine given on 30 March was followed by a similar reaction with a rise in temperature to 104.2° F. Recovery ensued in 24 hours.

MAPHARSEN

Case 67–1944.—After many exposures to infection during a 20-day period ending 26 December 1943, this patient developed a primary lesion at the base of the dorsum of the glans penis. There were also several small, shallow, punched-out ulcers with grayish bases, and several enlarged, freely movable inguinal glands on the left side. Darkfield examination findings and Kahn blood test were positive on 21 February 1944.

Arsenical treatment began with 0.03-gm. injections of mapharsen on 21 and 23 February. Three hours after the last injection the patient developed generalized muscular cramps, nausea, and headache, and the temperature gradually rose to 105° Fahrenheit. He was given 1,000 cc. of 5-percent dextrose solution intravenously immediately following the onset of symptoms, and recovery was complete in 8 hours.

Case 68–1944.—After exposure to infection on 6 November 1944, this patient developed multiple chancres on the shaft of the penis. A darkfield examination was positive for Treponema pallidum.

Arsenical treatment began with 0.03-gm. injections of mapharsen on 6 and 9 December, and a 0.06-gm. injection on 12 December. One and one-half hours after the last injection the patient had chills and fever and vomited. His face was flushed and toxic in appearance, the skin was dry and hot, the pharynx was slightly injected; the temperature was 105.6° F., respirations were 40, and the blood pressure was 128/80. Treatment consisted of complete bed rest, abundant fluids, intravenous injection of 1,000 cc. of 5-percent dextrose, and applications of heat. Recovery ensued in 2 days.

Case 69–1944.—The date of infection in this case is unknown. The patient denied extramarital exposure for at least 2 months prior to the onset of a penile lesion. Syphilis was diagnosed by positive findings in darkfield examinations made on 28 and 30 August 1944.

Arsenical treatment began with a 0.04-gm. injection of mapharsen on 1 September, followed by a 0.04-gm. injection on 4 September, and a 0.06-gm. injection on 8 September. The temperature was 100.8° F. in the evening following the first injection. Thirty minutes after the third injection the patient had a mild chill and some nausea but no vomiting. Within 8 hours the temperature rose to 103.8° F. and remained elevated for 4 days. He had mild abdominal pain with tenderness under the right costal margin. Complete blood count was within normal limits, and the urine was normal except for from 2 to 4 white blood cells per high dry field. Cholecystogram revealed a normally functioning gallbladder. At no time did the patient appear critically ill.

Treatment consisted of intravenous injections of dextrose, and a high carbohydrate, low fat diet, and recovery occurred in 4 days.

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Case 70–1944.—The date of infection in this case is unknown. Syphilis was diagnosed by positive Kahn blood reactions. From 2 December 1943 to 3 March 1944 the patient received 23 injections of mapharsen, a total of 1.38 grams. A third course of arsenical treatment was begun with a 0.06-gm. injection of mapharsen on 6 July. Thirty minutes after the injection a reaction occurred, manifested by nausea, vomiting, and dizziness. Mild reactions had occurred previously. The patient had eaten a full meal about 1½ hours before receiving the mapharsen. No specific treatment was given, and he recovered in 2 days.

Case 71–1944.—The luetic infection in this case existed prior to enlistment. About 1937 a penile lesion was treated with ointment by a civilian physician. At induction examination the Kahn blood reaction was positive, and the patient received 15 injections of mapharsen prior to his entry into the Navy. From 25 January to 31 March 1944 he received 20 injections of mapharsen, a total of 1.20 gm., and from 4 April to 9 May he received 10 injections, a total of 0.6 gram. Thirty minutes after the fifth bi-weekly injection of a third course, clinical manifestations of a reaction were nausea, vomiting, and dizziness. The patient had eaten a full meal about 1½ hours before the mapharsen injection. No specific treatment was given, and he recovered completely in 1 day.

Case 72–1944.—One month after exposure to infection on 6 January 1944 this patient developed an indolent appearing ulcer on the dorsal surface of the foreskin. A darkfield examination was positive for Treponema pallidum. From 6 February to 2 May he received 20 injections of mapharsen, a total of 1.17 grams. A third course of arsenical treatment began with a 0.06-gm. injection of mapharsen on 6 July and 30 minutes later a reaction occurred, manifested by nausea, vomiting, and dizziness. This patient had previously had occasional mild reactions, and he had eaten a full meal about 1½ hours before receiving the mapharsen. No specific treatment was given, and he recovered completely in 1 day.

Case 73–1944.—After exposure to infection on 3 May 1944, this patient developed an indurated, ulcerating penile lesion. A darkfield examination showed Treponema pallidum. Arsenical treatment began with 0.06-gm. injections of mapharsen on 3, 5, 6, 8, 10, and 13 June. One hour after the last injection the patient developed a fever of 103.4° F., nausea, and leukocytosis (16,000). The only treatment given was abundant fluids and the patient recovered fully in 1 day.

Case 74–1944.—One month after exposure to infection on 10 October 1943, this patient developed a small indurated lesion on the corona of the penis. A darkfield examination was positive for Treponema pallidum on 10 December 1943. A Kahn blood test was positive on the same day. From 11 December to 27 December he received 0.36-gm. of mapharsen. A reaction followed this treatment. Arsenical treatment was started again with a 0.05-gm. injection of mapharsen on 14 February, 1944 and was followed by a 0.05-gm. injection on 16 February, a 0.075-gm. injection on 18 February, and 0.01-gm. injections on 21, 23, and 25 February. Similar reactions occurred following the fourth, fifth, and sixth injections, manifested by soreness in the shoulder and arm muscles, malaise, and vomiting. The patient recovered from these reactions in 6 hours.

Case 75–1944.—This patient was exposed to infection on 7 January 1944,

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and on 26 January an initial lesion appeared on the surface of the penis near the frenum. Repeated darkfield examinations yielded negative findings, but Kahn blood tests on 3, 4, and 9 February were strongly positive. Arsenical treatment was instituted, with a 0.04-gm. injection of mapharsen on 4 February, and 5 hours later the patient reported to the sickbay complaining of a headache and fever. The temperature was 102° F., and there was generalized erythema. No specific treatment was given, and the patient recovered in 12 hours.

Case 76–1944.—When this patient was examined, a primary lesion, 1 day old, was found on the shaft of the penis. On 21 November 1944, a Kahn blood test was negative and darkfield findings were positive. A 0.06-gm. injection of mapharsen was given on the same day. The patient had a very severe, burning pain along the course of the vein up to his shoulder. A minute amount of the drug escaped about the vein, and this area became massively swollen, involving the entire arm and forearm. Despite hot wet dressings, several injections of morphine were required to control the intense pain. The pain lasted for 24 hours, but the swelling persisted for 3 days. At this time another injection of mapharsen was attempted. No extravasation or edema developed, but the pain in the vein recurred in somewhat less intensity than before. Penicillin was substituted and treatment completed without further trouble. This patient presented two types of reaction: (1) Chemical phlebitis due to mapharsen, and (2) true allergy to mapharsen.

Case 77–1944.—This patient was exposed on 5 October 1944, and darkfield examinations of a penile lesion yielded positive findings on 6, 7, and 8 November. Kahn blood tests were negative on 9 November, 1-plus on 17 November, and negative on 27 November. The patient developed chills and fever about 6½ hours after the fourth injection of 0.06 gm. of mapharsen on 23 November. The temperature rose to 102.4° F., and the pulse rate was 112 beats per minute. No treatment was instituted and he recovered fully in 1 day.

Case 78–1944.—This patient was admitted to the sick list on 26 April 1944 with a diagnosis of poisoning, therapeutic, acute, mapharsen, syphilis. He was discharged to duty well on 3 May.

He later reported to the sickbay complaining of fever and a rash on the legs. He had intermittent fever of 99° to 101° F., a mild pharyngitis, and redness and thickening of the skin over both legs. He was treated symptomatically and the fever, skin lesions, and sore throat subsided. Results of three urinalyses were negative, and a malaria smear yielded negative findings. Treatment with mapharsen was resumed on 17 May, with a 0.03-gm. injection and was followed by a 0.045-gm. injection on 20 May, and 0.045-gm. injections bi-weekly with no recurrence of symptoms.

Case 79–1944.—After 4 exposures of this patient during July and August 1944, the diagnosis in this case was made by positive darkfield examination of a penile chancre on 20 September. A Kahn blood test was positive on 29 September. A chill and febrile reaction followed the administration of 0.06-, 0.02- and 0.02-gm. injections of mapharsen respectively on 7, 16, and 23 October. Laboratory findings were negative and no treatment was given for this reaction. The patient recovered from the reaction within 48 hours, and treatment for lues was continued with 2,400,000 units of penicillin over a period of 7½ days.

Case 80–1944.—After exposure of this patient to infection in August 1944, syphilis was diagnosed on the basis of positive darkfield findings from a speci-

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men of a penile lesion. Kahn tests were negative. A reaction occurred about 20 minutes after 0.02 gm. of mapharsen had been injected on 9 October 1944. Previous 0.06-gm. injections of the drug had produced no reaction. The patient experienced chills and the temperature rose to 103° Fahrenheit. Another 0.02-gm. injection of mapharsen and a 0.2-gm. injection of bismuth resulted in a febrile reaction.

Laboratory findings were negative, and no treatment was given for these reactions. The patient recovered from the reactions in 36 and 48 hours respectively, and was subsequently treated with 2,400,000 units of penicillin over a 7½-day period with no untoward reaction.

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COVER PHOTOGRAPH

Typical of California mission-style architecture is the United States Naval Hospital at San Diego, Calif., the entrance to which is pictured at the top of the cover montage.

The skyscraper tower of the National Naval Medical Center at Bethesda, Md., portrayed in the middle of the montage, has become a familiar sight to many since the hospital's erection in 1940.

Shown below is the entrance to the United States Naval Hospital at Brooklyn, N. Y., an example of the prewar classical style of permanent hospital.

The activities depicted in the surrounding scenes are carried on in all Naval hospitals and Naval special hospitals. The Medical Department of the Navy is particularly vigilant in providing the best in treatment and care, welfare and recreation, and rehabilitation and therapeutic measures for all Naval and Marine Corps patients.

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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

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PREFACE

THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

With the establishment of the Dental Corps in 1912, the function of the BULLETIN was broadened to serve in a similar capacity for members of that Corps.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

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NOTICE TO CONTRIBUTORS

Contributions to the BULLETIN should be typewritten, double-spaced, on plain paper and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication; for example, addresses and dates, not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in headings and captions.

Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustration, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized. Recognizable photographs of patients should carry with them permission to publish.

All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

ROBERT C. RANSDELL, *Editor*,
Commander, Medical Corps,
United States Naval Reserve, Retired.

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U. S. NAVAL MEDICAL BULLETIN

VOL. 46 FEBRUARY 1946 NO. 2

SPECIAL ARTICLES

PROTECTION OF FEET IMMERSED IN COLD WATER

CLAIR R. SPEALMAN
Lieutenant H(S) U. S. N. R.

Prolonged immersion of feet in cold water results in vascular, neurologic, and muscular damage. The condition is commonly called immersion foot (*1*) (*2*) (*3*) and appears to be very similar to trench foot (*3*). Injury is primarily due to cold, but interference with venous return by dependency, immobility, or tight clothing, is probably a contributory factor. Feet so affected are at first swollen, waxy-white (except for scattered cyanotic areas), anesthetic, and pulseless (*2*). On warming, they become hyperemic and painful, and swelling may increase.

Although feet become ischemic as a result of prolonged exposure to cold water, they are hyperemic following brief exposure (*4*). Swelling and sensory impairment also occur as immediate reactions to cold. Anesthesia is not complete, and, in my experience, severe pain occurs periodically for many hours. Little is known of the intermediate stages between the hyperemic and ischemic conditions.

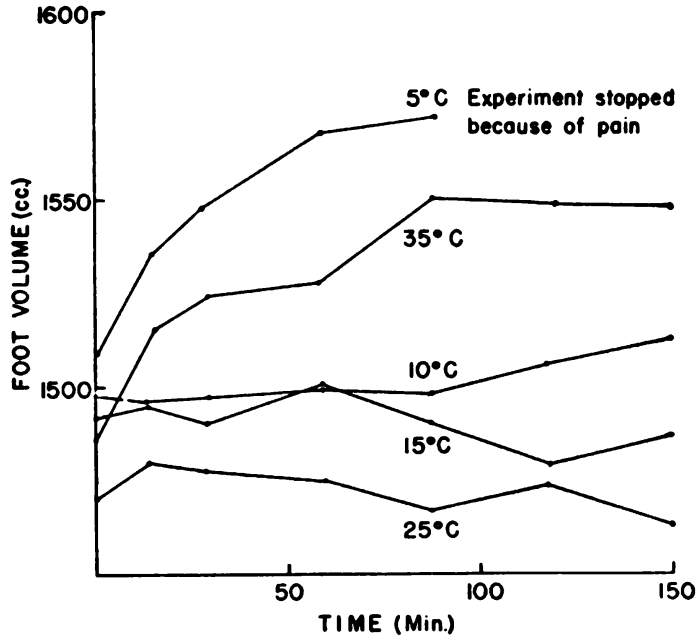
This study concerns especially the immediate effects of cold water. An attempt has been made to evaluate measures for preventing immersion foot, using the severity of immediate reaction to cold as a criterion for estimating protective value.

OBSERVATIONS ON IMMEDIATE PHYSIOLOGIC REACTIONS

The experiments designed to study the early changes occurring in feet immersed in cold water were performed in a room at a temperature (16° C.) such that the lightly dressed young male subjects were cold but not shivering. This was done in order to simulate practical situations in which foot damage occurs as a result of local cold. During each experimental period (2½ hours) the subjects sat with one

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foot immersed to a depth of 30 cm. in a well-stirred water bath. In these experiments, the water bath was maintained at various tempera-



1. Foot volume plotted against duration of immersion in water at the temperatures indicated. Room temperature was 16° C.

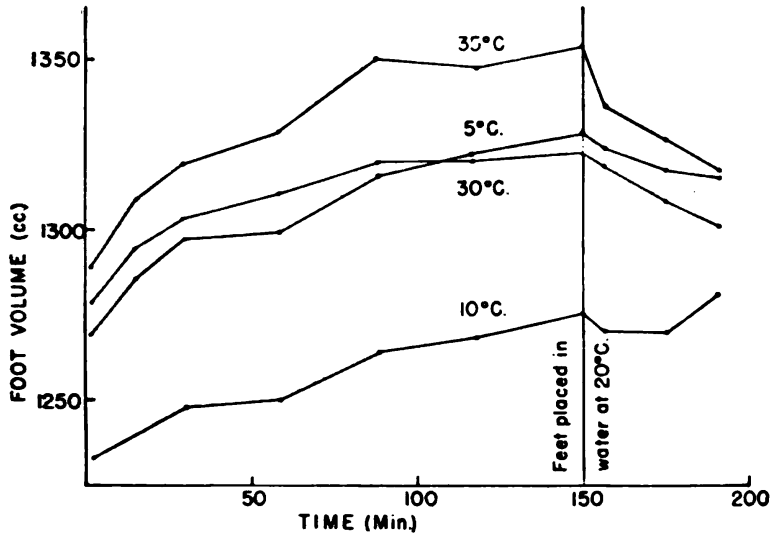
tures between 5° and 35° C. At the beginning of experiments and at intervals thereafter, the volume of the foot was determined, using an overflow type of water plethysmograph which was maintained at the same temperature as the water bath.

In moderately cold water (15° to 25° C.), feet showed little change in volume during the experiment. In warmer water (30° C. and above) or colder water (10° C. and below) there was considerable swelling (fig. 1). Swelling due to cold progressed with continued exposure, while that due to warmth did not progress appreciably after about an hour. On placing swollen feet in water at 20° C., swelling induced by cold regressed more rapidly than that induced by warmth (fig. 2). Pain and redness occurred in cold water only when swelling occurred.

These findings indicate that the reactions induced by cold are of an inflammatory nature; they are in agreement with those of Lewis (*4*). It might be presumed that the immersion-foot syndrome is the result of exposure to water sufficiently cold (approximately 10° C. and below) to cause these immediate reactions. Practical experience indicates this to be the case, for immersion foot appears to occur in sur-

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vivors of shipwreck only when water is colder than 8° C., according to Ungley (*5*), or 10° to 15° C., according to White (*6*).



2. This figure is constructed in a manner similar to that of figure 1 and shows the onset of swelling induced by warm and cold water and subsidence when feet are placed in moderately cold water (20° C.). Room temperature was 16° C.

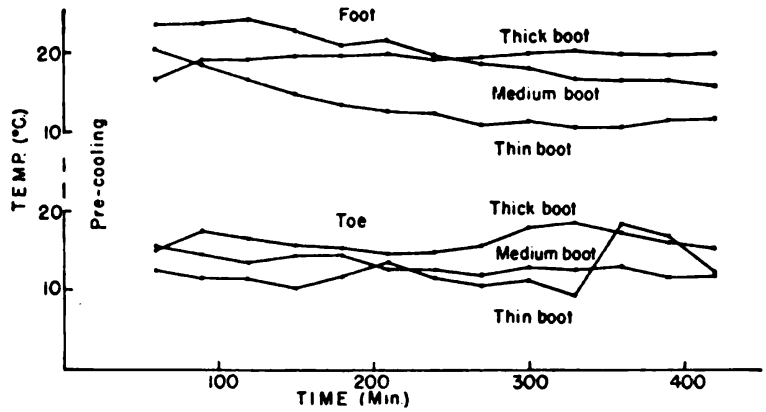
OBSERVATIONS ON PROTECTIVE MEASURES

Protection with insulation.—The insulation employed in these experiments was in the form of stocking-like boots made of closed cellular sponge rubber,[1] an insulating material which is not affected by water. Three boots (thin, medium, and thick) having different insulative values were used. The thin and medium boots had a thermal conductivity coefficient of 0.00015 cal./°C./cm./cm.²/sec. and a thickness of 6.5 mm. and 12 mm., respectively; the thermal conductivity coefficient of the thick boot was 0.000074 cal./°C./cm./cm.²/sec., and its thickness was 30 mm. This particular range of insulation was chosen after preliminary experiments had demonstrated that lesser amounts did not prevent intolerable pain in feet immersed in water near 0° C. More insulation was considered impractical because of bulkiness.

The conditions of these experiments were essentially similar to those employed earlier, except that colder water (0.5° C.) was used and experiments were continued longer (7 hours). In order to hasten thermal equilibrium, feet were precooled before boots were put on.

[1] Supplied by the B. F. Goodrich Co., Akron, Ohio.

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3. Temperatures of the great toe and outer surfaces of feet wearing the insulation indicated. Room temperature was 16° C., water temperature, 0.5° C.

The surface temperature of feet was determined by thermocouples attached with adhesive tape.

Although none of these boots prevented feet from becoming cold (fig. 3 and table 1), the thick boot afforded sufficient protection so that pain was experienced by only one of seven subjects. When either of the other boots was worn, nearly all subjects complained of pain.

TABLE 1.—*Protection afforded by boots*

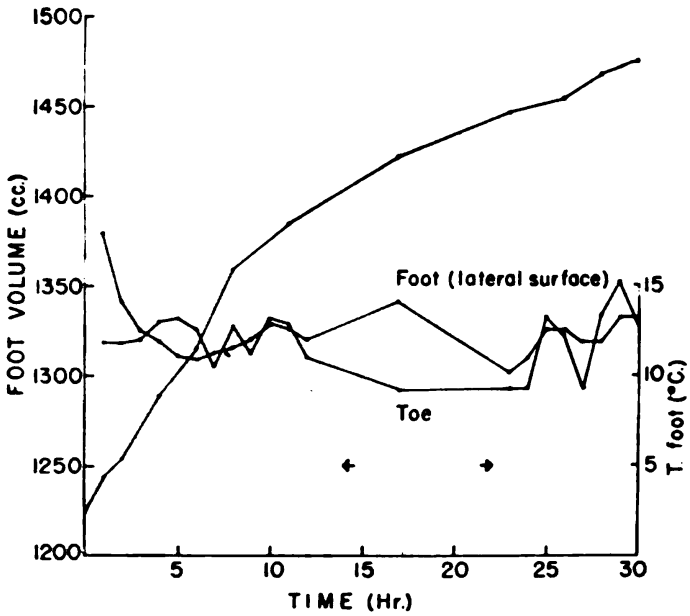
Boot	Total	Number of subjects		Average temperature (° C.)	
		Experiencing pain		Great toe	Outer side of foot
		Moderate	Severe*		
Thick	7	1	0	13.0	18.6
Medium	7	4	2	12.2	16.8
Thin	7	5	2	11.8	13.8

*Failed because of pain to complete the 7-hour experimental period.

The degree of swelling was not determined in these experiments, but in subsequent experiments of shorter duration (3 hours) on five subjects, foot volume was found to increase much more when the thin boot was worn (2.9 percent) than when the medium (1.4 percent) or thick boot was worn (1.7 percent).

It would seem that the thick boot afforded feet immersed in ice water (0.5° C.) almost enough protection to prevent the immediate reactions to cold. The medium boot allowed toes to become cold enough (below 13° C.) so that pain was experienced, while the thin boot allowed both feet and toes to cool to the point (from 12° to 14° C.) at which swelling and pain were very pronounced.

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4. Foot volume and foot temperature while wearing the thin cellular rubber boot. Room temperature was 16° C., water temperature, 0.5° C. The subjects slept much of the time during the interval indicated by the arrows.

A few experiments were performed to determine whether tissue damage (immersion foot) would occur in feet maintained at this lower temperature for prolonged periods. Subjects wore the thin boots with their feet immersed in water at 0.5° C. and remained in a room sufficiently cold so that shivering occurred occasionally. These experiments lasted 30 hours. The feet swelled considerably (fig. 4), but on removing them from water, edema regressed rapidly and disappeared within 2 or 3 hours. Subsequently there was no pain or sensory impairment. Evidently feet must be colder than in this experiment (from 10° to 14° C.) for damage to occur within a day or so. However it is possible that exposure for several days to these conditions would have caused immersion foot.

Experiments were also performed to show that results obtained when both feet are immersed in water are quantitatively similar to those obtained when only one foot is immersed, since most of our experiments were performed under the latter condition. The equilibrium temperature of a foot immersed in cold water is not importantly affected by the thermal condition of the other foot (fig. 5). These experiments were performed under conditions (room temperature 16° C.) such that the body as a whole was cold.

Value of body warmth.—Most of these experiments lasted 7 hours. They were performed at ambient temperatures such that the lightly

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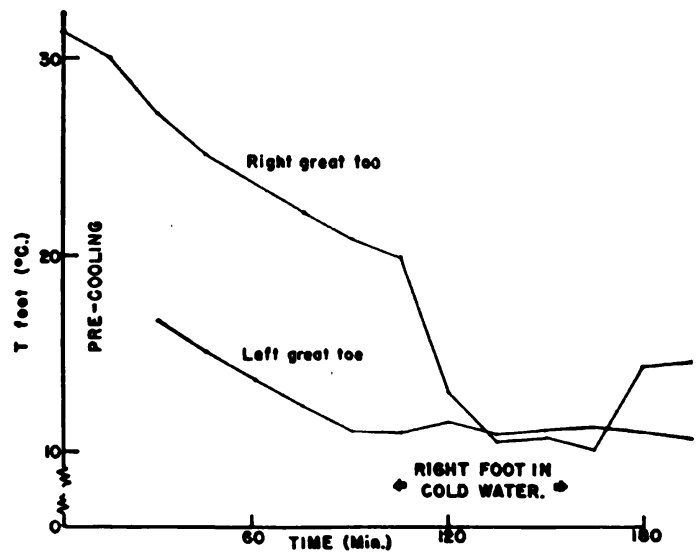
dressed subjects were comfortable (24° C.), uncomfortably cold but not shivering (16° C.), and shivering (10° C.). Subjects wore the thin cellular rubber boot. The water temperature was 0.5° C. and precooling of feet was carried out as before.

The temperature of the great toe of immersed feet in experiments at an ambient temperature such that subjects shivered was only slightly below that (from 10° to 14° C.) which existed when subjects were cold but not shivering. Toe temperature fluctuated widely (from 10° to 30° C.) when subjects were comfortable, but much of the time toes were considerably above the temperature at which immersion foot occurs (fig. 6). It would seem, therefore, that keeping the body warm would aid greatly in preventing injury to feet by cold.

TABLE 2.—*Records of skin temperatures*

Temperature room (° C.)	Temperature trunk (° C.)	Temperature finger (° C.)	Temperature toe (° C.)	Remarks
10	31.9	16.1	13.8	Shivering. Temperature of toe of immersed foot, 8° to 14° C.
16	32.7	18.7	17.2	Uncomfortably cold. Temperature of toe of immersed foot, 10° to 14° C.
24	34.0	33 9	29.4	Comfortable. Temperature of toe of immersed foot, 10° to 30° C.

A more precise description of the general thermal condition of the subjects of these experiments can be obtained from the record of skin temperatures in table 2. In this table, skin temperatures of the index finger, great toe and trunk are those existing at the end of experiments. Trunk temperatures are means of values recorded from three regions of the trunk—anterior thoracic, posterior thoracic, and lum-

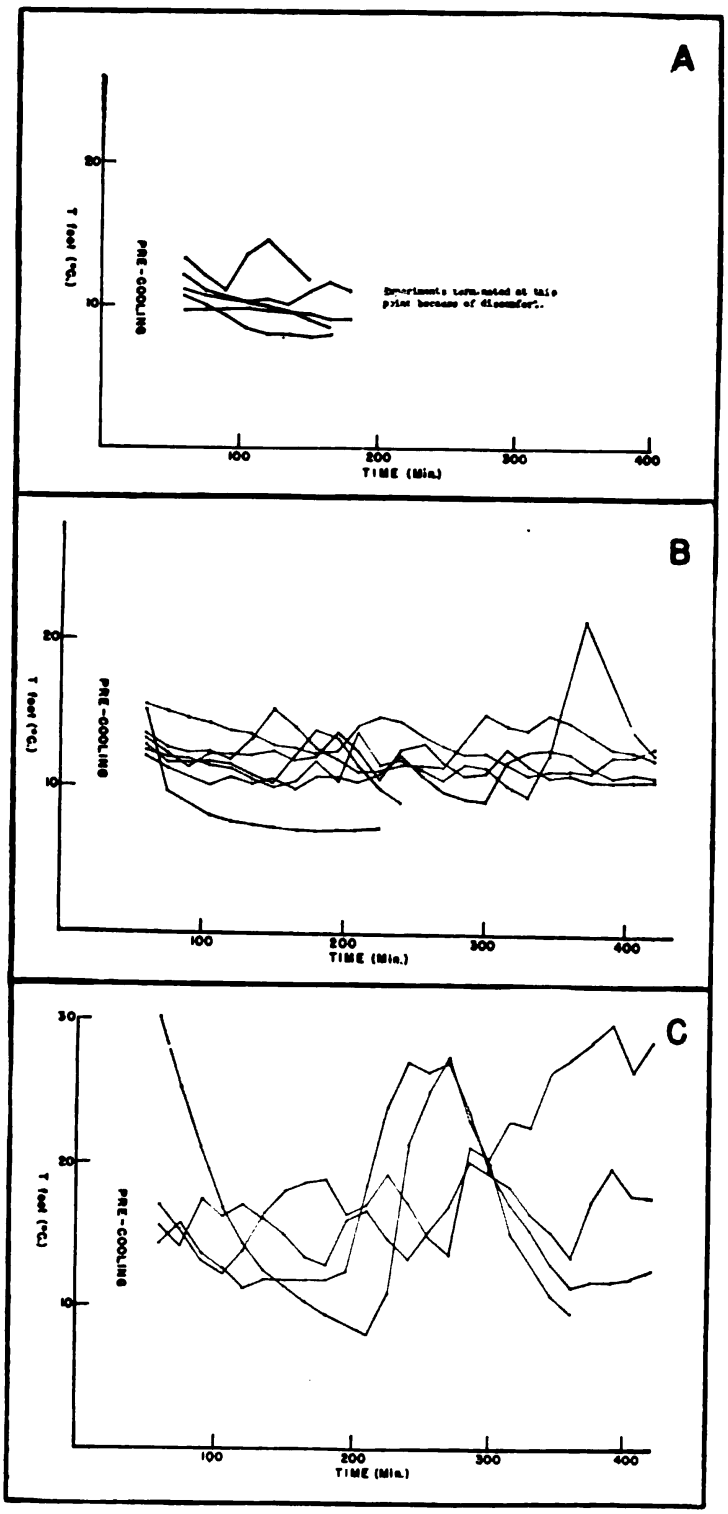


5. Foot temperature measurements, showing that the temperature of a foot immersed in ice water (0.5° C.) is not noticeably influenced by the temperature of the other foot when the entire body is cold. The left foot was protected by the thin cellular rubber boot. Room temperature was 16° C.

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bar. Thermocouples attached with adhesive tape were used to obtain these measurements.

Value of foot exercise.—The experimental conditions for determining whether exercising the feet produces an appreciable rise in foot

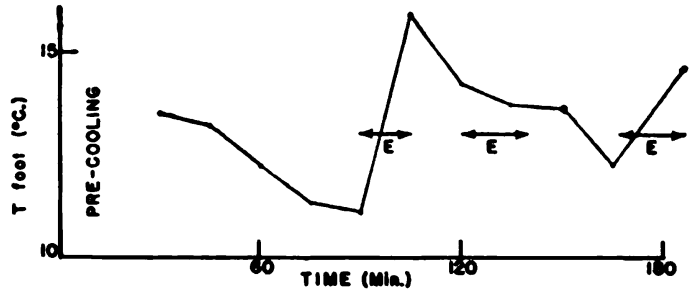


6A. Skin temperature measurements obtained on feet immersed in ice water (0.5° C.) plotted against time. Feet were protected by the thin cellular rubber boots. Room temperature was 10° C.

B. Same as figure 6A except that the room temperature was 16° C.

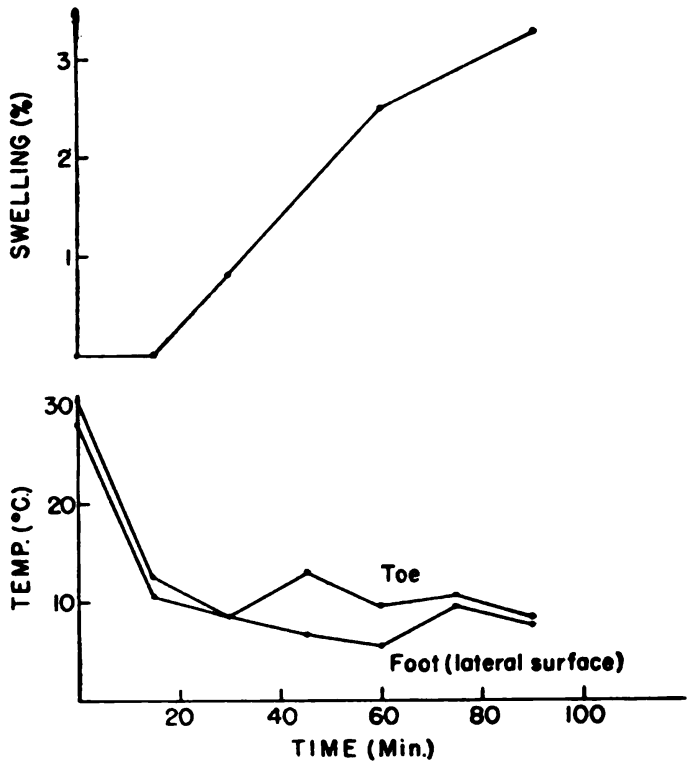
C. Same as figure 6A except that the room temperature was 24° C.

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7. The effect of foot exercise (E) on the temperature of feet immersed in ice water (0.5° C.). These results may be compared with those in figure 5 which were obtained on the same subject under similar conditions but in the absence of exercise. The thin cellular rubber boot was worn. Room temperature was 16° C.

temperature were similar to those previously described. Sufficient time was allowed for the establishment of thermal equilibrium between the feet and water, then the subjects flexed and extended their toes as strongly as possible from 40 to 80 times per minute during several periods of about 15 minutes each. Room temperature was 16° C., and subjects wore the thin boots. The procedure was found to be effective in elevating the temperature of feet under these conditions (fig. 7).



8. Swelling (percent) and temperature (° C.) of feet while wearing stockings impregnated with petrolatum. Room temperature was 16° C., water temperature, 0.5° C.

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Value of petrolatum.—A few experiments were performed in which feet were encased in knitted woolen stockings impregnated with petrolatum. This was done because it has been contended (*7*) that oils and greases possess special protective value against wet cold. The tests were made under cold conditions (room temperature, 16° C.) with the feet immersed 20 cm. deep in water at 0.5° C. Swelling proceeded twice as rapidly (fig. 8) as in the experiments in which the thin boots were worn. Feet were extremely cold and very painful. One subject became nauseated, possibly because of pain. The results of these tests suggest that petrolatum does not afford any great protection to feet immersed in cold water.

COMMENT

One purpose of the present study was to determine the extent to which feet immersed in ice water can be protected by insulation when other conditions are extremely unfavorable. The subjects sat at rest and wore insufficient clothing to keep warm. Although impractically large quantities of insulation are required to protect feet indefinitely under such conditions, protection for a day or more can be achieved by relatively little insulation; for example, the thin cellular rubber boot used in this study. It should be pointed out that the same degree of protection can be achieved with an equivalent amount of ordinary footgear, provided rubber boots or overshoes are worn to prevent the insulation from becoming wet.

This study has also shown that feet can be kept much warmer when the body as a whole is kept warm and when feet are exercised. These measures should prolong considerably the duration of exposure that can be tolerated without damage to feet. Measures designed to promote lymphatic and venous flow have been recommended for preventing foot damage by cold (*3*). These include avoiding pressure on extremities, moving about to aid circulation, and keeping feet elevated as much as possible in situations where body movement is restricted. The experimental technic employed in this study was not appropriate for evaluating these measures; however it is fairly certain that they are beneficial.

CONCLUSIONS

1. Hyperemia, swelling, and pain occur quickly in feet maintained at temperatures below 12° to 14° C.; however, serious injury (immersion foot) does not occur rapidly at temperatures near the upper limit of this range. Feet maintained at an average temperature of 12° C. for 30 hours recovered quickly.

2. A thin layer (6.5 mm.) of good insulating material (heat conductivity, 0.00015 cal./°C./cm./cm.^{2}/sec.) maintains feet immersed in

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ice water (0.5° C.) at a temperature (from 12° to 14° C.) at which immersion foot does not occur rapidly. However very large quantities of insulation are necessary to keep feet above the temperature at which immersion foot may occur if exposure is sufficiently prolonged. These observations were made on subjects sitting in the cold with legs dependent.

3. Keeping the body warm aids greatly in keeping the feet warm. When the body as a whole was kept comfortable, feet encased in the insulation described above, and immersed in water at 0.5° C., remained much of the time above the temperature at which injury by cold occurs.

4. Exercising the feet should be of value in preventing immersion foot, since exercise elevates foot temperature and facilitates lymphatic and venous flow.

5. Petrolatum does not appear to afford any great protection to feet immersed in cold water.

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STUDY OF 100 CASES OF ABDOMINAL PAIN IN SERVICE WOMEN

BARNES GILLESPIE
Lieutenant (MC) U. S. N. R.

Approximately 25 percent of the total admissions to the WAVES' surgical service of this hospital are the result of acute pain in the right lower quadrant of the abdomen. This is an analysis of 100 such patients admitted over a 4-month period.

The differential diagnosis of acute pain in the right lower quadrant of the abdomen is more difficult in the female than in the male, due in large part to the changes which occur in the female reproductive organs with each menstrual cycle. It is well known that normal physiologic changes in the ovary may give rise to symptoms in the lower abdomen. When these symptoms are present in the right lower quadrant, many young women seek medical consultation, with the fear, and sometimes firm belief, that they have acute appendicitis. Aware of the many atypical modes of onset of acute appendicitis, the dispensary medical officer is fully justified in requesting that the patient be observed in a hospital equipped for emergency surgery, until a diagnosis is established.

The first and most difficult responsibility of the surgeon is to determine either that an acute surgical emergency exists, or that it does not exist. It is hoped that an analysis and discussion of the cases seen here may be helpful.

At the time of discharge, the following facts were recorded for each case: (1) Admitting diagnosis; (2) age and length of time in the service; (3) location and duration of the pain; (4) presence of nausea or vomiting; (5) diarrhea, or constipation, or any urinary symptoms; (6) menstrual history, with date of onset of the previous menstrual period; (7) white blood cell count, percentage of polymorphonuclear leukocytes, the erythrocyte sedimentation rate, urinalysis, and any roentgenographs taken; (8) operation if performed and pathologic changes found both in the operating room and in the laboratory; (9) disposition of the case and number of days in the hospital; and (10) discharge diagnosis.

Twenty-eight of the 100 patients were operated upon. The accompanying tables and charts summarize the various findings.

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Admitting diagnosis:

D. U., appendicitis, acute	66	
D. U., abdominal pain	7	
D. U., pelvic inflammatory disease	4	
D. U., surgical observation	2	
D. U., medical observation	2	
D. U., gastro-enteritis	2	
D. U., appendicitis, subacute	1	
	—	84
Appendicitis, acute	7	
Appendicitis, chronic	7	
Gastro-enteritis, acute	1	
Salpingitis, chronic	1	
	—	16
Total		100

It is noteworthy that 84 percent were admitted with diagnosis undetermined, and 66 percent with diagnosis undetermined, appendicitis, acute. Cases of infected abortion were not included in this series. There were no cases of ectopic pregnancy or stone in the urinary tract admitted during this time. Either of these diseases may give pain in the right lower quadrant of the abdomen and should be considered in a discussion of the differential diagnosis.

The age group here is probably representative of an over-all age group for the WAVES. Eighty-seven of the patients were between the ages of 20 and 24, and 13 of them were over 24 years. Thirty-nine of them had been in service less than 9 months, and 61 of them over 9 months.

A total of 78 percent of the patients had either nausea or vomiting, or both. This common symptom seems to depend very much on the individual. It is noted that 67 percent of these patients gave a history of regular bowel movements.

Nausea and vomiting

Nausea alone	38
Vomiting alone	2
Nausea and vomiting	38
No nausea or vomiting	22
Total	100

Diarrhea	17
Constipation	16
Regular bowel movements	67
Total	100

Segmented forms

Under 80 percent	65
Over 80 percent	35
Total	100

Roentgenographs taken

G. I. series	4
Barium enema	8
Chest	1
Total	13

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Leukocyte count	
Below 10,000	39
10,000 to 15,000	29
15,000 to 20,000	24
Over 20,000	8
Total	100

Many of the patients not operated on had a high leukocyte count with an accompanying shift in the differential count. Eighteen of the 28 patients operated upon had white blood cell counts over 10,000. In only 9 of these was an acutely inflamed appendix found. However in these 9 the leukocyte count was elevated in each, ranging from 13,400 to 27,800.

The erythrocyte sedimentation rate in general was in proportion to the amount of inflammation found at operation. However this was not a constant finding. In one case of proved acute appendicitis, the sedimentation rate was normal, and in three operative cases in which no acute inflammation was found, the sedimentation rate was elevated. A wide variation was found in the cases which subsided with conservative treatment. Roentgenographs were usually taken when the symptoms persisted for as long as a week. In cases of suspected chronic appendicitis, a barium enema x-ray study was requested.

Operations		*Findings*	
Not operated upon	72	Appendicitis, acute	9
Operated upon	28	Appendicitis, subacute	15
		Ruptured follicle of ovary	3
Total	100	Ovarian cyst on twisted pedicle	1
		Total	28
Emergency operation	18		
Elective operation	10		
Total	28		

It is noted that 28 of the 100 patients were operated on, 18 as emergencies and 10 as elective cases. The primary diagnosis in all cases was either acute or chronic appendicitis. An acute appendicitis was found in only 9 of these. In one case the appendix had perforated, but there was only local peritonitis. The pathologic findings recorded here include both the operative and laboratory findings. Pathologic changes to account for the patient's symptoms were found in the appendix in 9 instances and in the ovary in 4.

It is difficult to find a perfectly normal appendix. Some histologic evidence of subacute or chronic inflammation can be found in almost every appendix in a person past the age of adolescence. It is doubtful that the amount of inflammation found in many of these 14 cases diagnosed as subacute and chronic appendicitis was the cause of the

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acute pain which brought the patient to the hospital. However all of these patients left the hospital symptom free.

Discharge diagnosis:

Cyst, ruptured ovarian	30
Gastro-enteritis, acute	21
Appendicitis, acute	17
Appendicitis, chronic	9
Constipation	8
Dysmenorrhea	6
Gastritis, acute	4
Salpingitis, acute	4
Salpingitis, chronic	1
Total	100

It is difficult to establish a discharge diagnosis for those patients who recover immediately with rest in bed. Thirty patients were discharged with the diagnosis of a ruptured ovarian cyst or follicle, 21 with gastro-enteritis; 8 of the cases were definitely on a basis of constipation, and 6 patients had a dysmenorrhea. No one can know how many of these patients had appendicitis which subsided with conservative treatment. It is contended that this depends on whether or not there is an obstructive mechanism present, either in the lumen or in the wall of the appendix.

It has been stated that 70 percent of cases of appendicitis will subside with conservative treatment. This would be a difficult figure to

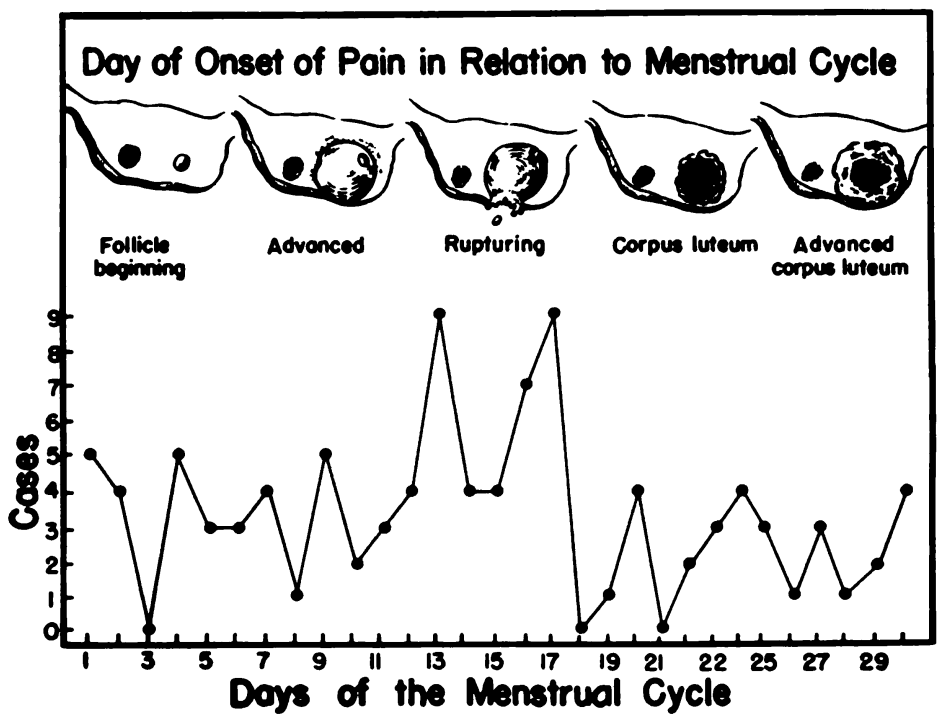


Figure 1.

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prove. Cases of appendicitis do subside, undoubtedly, to produce the fibrosis, adhesions and obliteration of the lumen often found at operation. We do not know how much pain can have its origin in an obliterated appendix, fibrosis in the wall of the appendix, or adhesions binding the appendix to the bowel or to the parietal peritoneum. Probably most of the pain is from adhesions, although many have extensive adhesions in other parts of the abdomen without suffering unduly. Possibly interference with mobility of the cecum is a large factor.

Figure 1 shows the relation of the day of onset of pain to the first day of the last menstrual period. The physiologic changes in the ovary during the menstrual cycle are shown diagrammatically. The greatest number of patients had the onset of their pain in the midperiod from the thirteenth to the eighteenth day. The rise had been expected both during and just prior to menstruation. Ninety-two of these patients gave a history of having normal menstrual periods. Many, however, varied a few days in the length of the cycle.

Frequently patients have given a history of having mild pain in the lower abdomen each month in the midperiod; this is known as *mittelschmerz*. It is not known whether this pain is due to rupture in the ovary, or (more probably) to irritation of the peritoneum from the follicle fluid and a small amount of bleeding. In two of these cases in which a ruptured follicle was found in the ovary at operation, the onset of pain was on the sixteenth day of the menstrual cycle, and in the third case on the twenty-fifth day. In the fourth case,

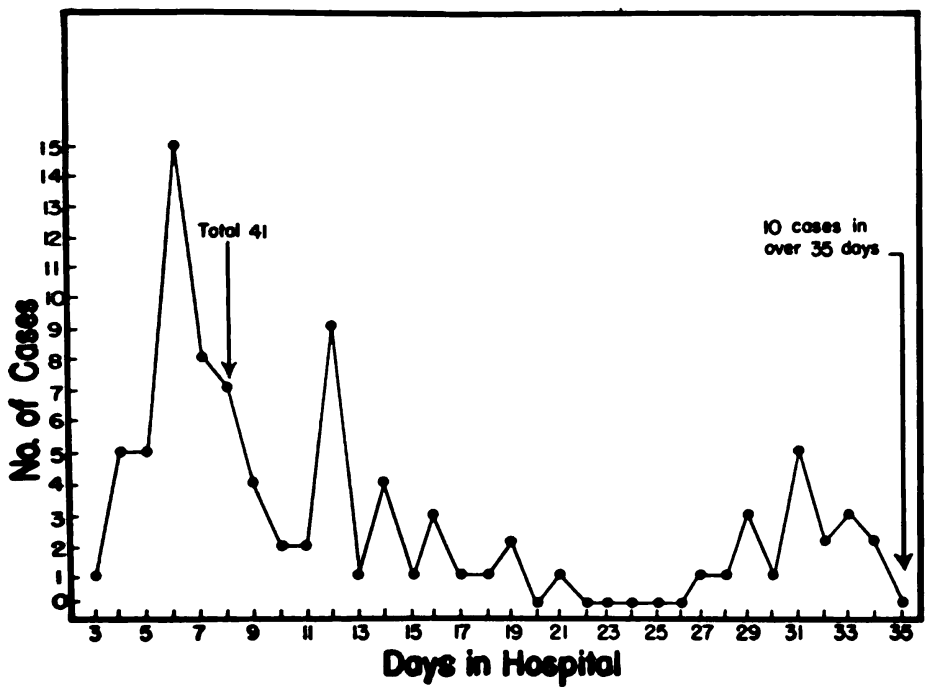


Figure 2.

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that of rupture of a small corpus luteum cyst, the day of onset of pain was on the twenty-sixth day of the cycle.

Figure 2 shows the number of days each patient was in the hospital. It is noted that 41 of these patients were in the hospital less than 9 days. This represents the group of cases which subsided spontaneously with very little or no treatment. In a goodly number of these cases, all symptoms had subsided by the morning after admission; however it was necessary to keep these patients in the hospital from 4 to 6 days longer. Most of the patients having routine appendectomies are discharged to duty about 1 month after operation; this includes 10 days in the hospital and 2-week leave.

In a follow-up of these 100 patients, which covers a period of from 4 to 8 months, only 3 of these patients have returned to the hospital. One had persistent symptoms referred to the right lower abdominal quadrant. An obliterated, fibrosed appendix was removed, with complete relief of the patient's symptoms. The second patient returned with the same symptoms. An exploratory operation was done and a relatively normal appendix removed. She had relief of symptoms after the operation, but after returning from 2-week leave, the symptoms recurred. The third patient, who had an acutely inflamed appendix at operation, and had a smooth postoperative course, developed hysteria, and it was necessary to discharge her from the service.

There was a minor wound infection in a patient whose appendix had perforated shortly before operation; otherwise there were no complications of a serious nature which prolonged hospitalization in the 28 operative cases studied. In 15 of these 28 cases no pathosis of an emergency nature was found. In the four patients with rupture of an ovarian cyst or follicle no striking differentiating points can be maintained. The duration of their pain is similar to that occurring in patients with acute appendicitis. The white blood cell count ranged from normal to 20,000, with a shift in the differential. Three patients experienced both nausea and vomiting; however 2 of them gave a history of diarrhea, as compared to 1 of the 9 patients with acute appendicitis. This might be significant but difficult to explain.

CONCLUSIONS

From a study of 100 young women with acute pain in the right lower quadrant of the abdomen certain conclusions may be drawn:

1. Only nine of these patients had an acutely inflamed appendix at operation. It can be assumed that many of these patients were having symptoms from relatively normal physiologic changes in the ovaries. A more careful evaluation relative to menstrual history and previous pain in the midperiod prior to admission might serve to reduce the number admitted.

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2. In this series of cases an acutely inflamed appendix was always associated with a leukocytosis; however, many who recovered spontaneously had both a leukocytosis and a shift in the differential count. The erythrocyte sedimentation rate was of no value in the differential diagnosis.

3. It is impossible to determine what cases of inflammation of the appendix will subside, and many times it is impossible to rule out an irreversible inflammatory process in the appendix and establish that the disease is of a more benign nature.



NEW DRUG FOR MALARIA

The I. C. I. drug M. 3349 has an action in malaria comparable to that of quinine and atabrine, the fever due to Plasmodium falciparum and P. vivax being promptly controlled and the blood becoming negative. In quartan infection, however, the effect is relatively poor.

Of 60 patients with P. vivax infection treated and kept under observation for a period of several weeks, 18 showed clinical relapse after intervals varying from 19 to 56 days, and 7 showed temporary recurrence of the parasites in the blood, with no fever. Thus the early relapse rate during this period of observation is 30 percent, comparable with that usually seen after P. vivax infection treated with quinine or atabrine for a similar period.

Of 51 patients showing P. falciparum infection and observed for several weeks, none showed a relapse of falciparum infection and 8 showed a recurrence of fever with P. vivax in the blood; some of these are possibly cases of previously undetected mixed infection, but the possibility of fresh infection cannot be ruled out.

In persons who, apart from the malaria, are healthy and in fairly good physical condition, the toxic effects seen after administration of the drug; i. e., nausea and vomiting, are slight and present no great difficulty. In persons with complicating diseases, particularly of the respiratory tract, the danger of serious toxic effects seems to be greatly increased. In a series of 106 cases among sick destitutes, 5 deaths were seen. Four of these were in patients with serious complicating diseases, but in these and in the fifth case it appears that the drug probably contributed to the causation of death. Toxic effects were first observed with the dosage of 0.6 gm. per day as recommended by the manufacturers, but they were not eliminated by the reduced dosage of 0.4 gm.; in fact, three of the deaths occurred on such a dosage.

The drug is of interest because it is apparently an entirely new chemical compound with a powerful antimalarial action, but in its present form its toxicity would appear likely to prevent its general use. Possibly some allied chemical compound may be equally or more effective and less toxic.—DAS GUPTA, B. M.; LOWE, J.; and CHAKRAVARTI, H.: M. 3349 (palubrine) in treatment of human malaria. Indian M. Gaz. 80: 241–245, May 1945.

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FILARIASIS AMONG WHITE IMMIGRANTS IN SAMOA

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In 1925 Buxton (*1*) recorded certain observations on the blood smears of immigrants resident in Samoa for various periods. He concluded that "in the third or fourth year after arrival the microfilariae may have reached the circulation." Among 43 Europeans (British, French, and Scandinavian) examined in this study, no circulating microfilariae were demonstrated in the blood smears of persons in residence less than 9 years. Buxton's conclusion was based on positive smears found among Chinese plantation laborers in residence for 3 years.

Although no data relative to the appearance of clinical filariasis in this group were included in the report, it was observed that filarial lymphadenitis and centrifugal lymphangitis could occur in white immigrants within a few months after their arrival in Samoa. One European, experimentally bitten by mosquitoes known to be harboring infective microfilariae, developed such a lymphangitis and lymphadenitis within 5 months. The significance of these observations is now apparent.

Studies of filariasis with reference to service personnel in Samoa have been carried out and the disease has been investigated at some length among native Samoans. Contrasting disease pictures in these two groups have been pointed out (*2*) (*3*). The clinical study herewith reported deals with a third group, European immigrants who remain in Samoa for considerable periods. It was undertaken with a view toward determining factors associated with the incidence of symptoms due to filarial infection, and the long-term course and the prognosis of this disease among the members of such a group.

METHODS

Case histories, with emphasis on pertinent facts relative to filarial infection, were obtained by personal interview with 80 white immigrants in residence in Samoa for 10 years or longer. An arbitrary minimum of 10 years was selected in order to insure the inclusion in the series of a substantial number of positive smears, and to make possible an evaluation of the long-term progress of the disease among the members of the group.

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White immigrants in the area, working in a civilian capacity, for the most part in nonarduous occupations, do not usually develop filarial symptoms with the rapidity recently observed in military personnel under wartime conditions. Since it is evident from previous studies that blood smears by ordinary technics are not, in general, a reliable indication of the clinical course of the disease, no attempt was made to obtain blood smears of the persons studied. In those instances in which smears had been made, the presence or absence of circulating microfilariae appeared unrelated to the clinical symptomatology.

During each interview, a questionnaire was completed by the examiner, covering in detail the following points: Age; years of residence and place of residence prior to arrival; occupation, economic status, and locus of activity in Samoa; time of onset, nature, anatomic location and clinical course of the initial symptoms; character, number, and clinical course of recurrences; current symptoms and signs; nature of preventive measures carried out and degree of exposure to the native reservoir of infection; personal observations of the patient concerning filariasis among immigrants; and laboratory data when available. In connection with the latter, several persons whose blood smears were examined by Buxton in 1924 and 1925 are included in the present group.

Certain objections to this method of survey are apparent. It is realized that clinical histories are not always accurate, but this factor is considered of less consequence than might be supposed because of the lively interest in filariasis in this "hyperendemic" area, a willingness to cooperate displayed without exception by all persons interviewed, and a consequent profusion of detail relating to individual experiences with the disease. Physical examination was carried out in cases of elephantiasis, and additional histories were obtained to rule out other pathologic conditions.

The group studied comprises approximately 75 percent of white Europeans who, at the present time, have lived continuously more than a decade in the area, and is therefore considered a representative group.

RESULTS

The persons studied were white men and women who, either by choice or necessity, had spent a substantial portion of their adult life in the Samoan area, the mean age on arrival being 28.7 years and the average duration of residence 26 years. Five persons with positive histories and six with negative histories had spent periods of from 2 to 15 years in other filarial endemic areas, notably Fiji, New Guinea, the New Hebrides, and Tonga. One had had a single episode of filarial lymphangitis in Tonga prior to arrival in the

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Samoan area. The majority had previously resided in a temperate, nonfilarial area.

It is thus apparent that the group was, on the whole, not exposed to filarial infection until late in the third decade of life, and that exposure continued, on the average, for more than a quarter of a century. This exposure, however, was received under circumstances unattended by the stress of military operations, and in most instances without the necessity for strenuous physical effort which appears to be associated with increase of symptoms (*3*). Service personnel, on the other hand, following the outbreak of the recent war, were exposed to heavy inoculation over short periods of time, under living and working conditions quite unlike those experienced by this group. The average age of servicemen on arrival was comparable but slightly lower (21.8 years in one of the early series (*4*)), whereas the native population ordinarily receives initial contact with filariasis during infancy.

The case histories, with respect to symptoms or signs of filariasis, group themselves as follows:

TABLE 1.—*Symptoms and signs of filariasis*

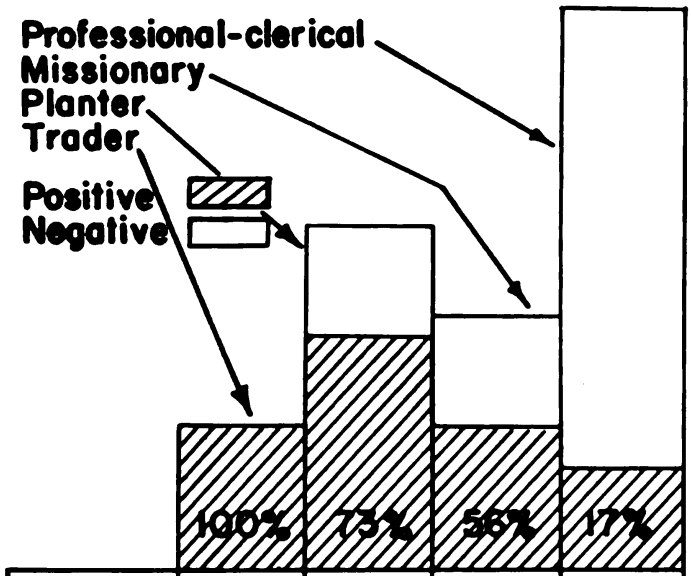
	Negative	Positive	Total
Male	27	27	54
Female	15	11	26

Occupationally it was possible to classify all those studied into four general groups: Trader, planter, missionary, and professional-clerical, the latter including office workers, government officials, managers, and the like.

The relation of occupational group to incidence of filarial symptoms is shown in the accompanying graph.

Differences in incidence of symptoms among these occupational groups is considered significant and is explained as follows. Operators of trading stations live and work in native village areas where infected vectors are most numerous. In addition the mosquito control measures taken by traders were found to be of the most casual nature. Plantations are isolated from village areas but ordinarily include quarters for native labor within easy vector flight range of the planter's dwelling. Missionary personnel usually reside in or near native quarters. In addition their work not infrequently involves trips about the islands, during which time they are in constant contact with the native reservoir of infection. It may be added that church meetings held in early morning and late afternoon inside unscreened buildings offer ideal feeding grounds for aëdes mosquitoes.

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Negative	0	5	7	30
Positive	9	14	9	6

Occupational groups.

The professional-clerical worker group, showing the lowest percentage of positive histories, is also the group in which mosquito control measures and isolation from the native reservoir were found to be at a maximum. None of the persons interviewed was engaged in occupations involving strenuous manual labor.

Among those with positive histories, the appearance of initial symptoms occurred, on the average, after 7.5 years' residence in the area, the mean for males being 6.4 years, for females 10.3 years. It is not possible to draw valid conclusions from these figures regarding the influence of sex upon incidence, although it appeared that in general the women of the group, with the possible exception of missionaries, were less exposed to infection than the men, chiefly because of their daily living habits.

Initial symptoms of retrograde lymphangitis and swelling, with or without abscess, appeared in the upper extremity in 30 instances and in the lower extremity in seven. Only one person noted orchitis as a presenting symptom, although seven of the males gave a history of subsequent orchitis and funiculitis. All except one of the latter had, while in Samoa, undergone surgery for "hydrocele" which may or may not have been on a filarial basis.

The record of recurrent bouts of illness attributed to filarial infection proved most interesting and rather illuminating. It was not at all uncommon to elicit information to the effect that the patient had

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had typical filarial lymphangitis with painful swelling of an extremity four or five times a year for many years; such attacks were often accompanied by severe rigors, fever, and occasionally by abscess formation in the affected part. Several persons when interviewed were, in fact, confined to their beds by acute attacks of *mumu*[1] and offered an opportunity for observation of the acute disease in various stages.

In persons who had undergone repeated episodes of filarial lymphangitis it was stated that after the age of 50 or 60 the attacks become less frequent and less severe.

In addition to the usual episodes of lymphangitis, lymphadenitis, abscess, and so forth, another clinical syndrome was described by three persons. Following exposure to rain and sun, they noted the appearance of itching blisters and red patches on the trunk or extremities, or both, together with painful swelling and a red streak progressing in retrograde fashion down the inner aspect of the arm or leg and lasting 4 or 5 days.

At the time of survey, 23 of the 38 subjects with positive histories were free from symptoms referable to filariasis, and although many of them had experienced transient swelling of an extremity during attacks of lymphangitis, no lasting deformity had resulted. The total number of recurrences in relation to the presence of elephantiasis is summarized in table 2.

TABLE 2.—*Recurrence of acute symptoms*

Number of recurrences	1–10	11–20	21–40	41–60	Over 60
Without elephantiasis	17	2	2	2	0
With elephantiasis	0	5	2	4	4

It became evident during the course of this survey that the number and frequency of recurrence of acute filariasis are at best only of rough prognostic value with reference to the eventual appearance of persistent swelling of appreciable degree. I have examined a number of persons with well-substantiated histories of more than a score of attacks of typical filarial lymphangitis in the upper extremities, and in approximately one-third of these no epitrochlear glands were palpable. It should be added that in this area, where minor bacterial infections of extremities are extremely common, the mere presence of palpable axillary, inguinal, or epitrochlear glands is of little value in the diagnosis of filarial infection without good substantiating evidence.

[1] Literal translation: Red. Ordinarily refers to filarial lymphangitis, but also is used loosely in the area to mean elephantiasis and other manifestations of filariasis; e. g., *mumu afi* (*mumu* which burns), *mumu tatanu* (internal *mumu*), *mumu a tamaiti* (*mumu* of children), and so on.

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Data relative to the 15 cases of elephantiasis are shown in table 3. The column "total recurrences" refers to the number of acute bouts of illness experienced during the course of the disease since onset. It was not feasible to classify acute symptoms exactly according to extremities or parts affected, since in many instances multiple extremities were involved, and constitutional symptoms such as chills and fever were also present.

TABLE 3.—*Cases with persistent lymphatic stasis*

Sex	Age	Years in residence	Occup. group*	Years in residence at onset	Total recurrences	Elephantiasis
Female	76	53	M	14	70–80	Moderate, both legs.
Do	74	52	M	2	50–60	Moderate, left leg.
Do	52	21	P	5	15–20	Slight, left forearm.
Do	63	35	P	12	20–30	Moderate, right leg and left arm.
Male	64	39	M	3	50–60	Slight, right forearm.
Do	71	23	P	4	10	Slight, left ankle.
Do	67	39	P	2	50–60	Moderate, both legs.
Do	62	17	P	**	15	Slight, right leg.
Do	41	15	P	6	12	Very slight, right upper arm.
Do	76	53	P	3	20	Slight, right arm.
Do	61	34	P	3	30–35	Moderate, right arm.
Do	57	32	T	3	100	Slight, left ankle and foot.
Do	67	28	T	4	50–60	Moderate, left leg.
Do	57	36	T	7	60–70	Do.
Do	78	50	T	15	100	Severe, all extremities.

*M: missionary, P: planter, T: trader. **6 months.

The group showing elephantiasis comprises 18 percent of the total number studied. Seven of the cases were minimal and caused no impairment of function; seven were of moderate severity and caused obvious deformity and corresponding inconvenience to the patient. Only one case was of such severity as to approximate textbook descriptions of elephantiasis.

From table 3 it is evident that permanent swelling of filarial origin in the group studied is a disease of advanced age (mean age 64.3 years), and follows prolonged exposure (mean exposure 35.1 years), with numerous recurrences of the acute manifestations of filariasis. It is, however, equally clear that the appearance of permanent lymphatic obstruction bears no simple relationship to the degree or duration of exposure or to the number of acute manifestations, which can perhaps be considered as periodic imbalances in the host-parasite relationship and which in many instances are of an allergic nature (*5*).

On the basis of the patients considered in this survey, it appears that when previously uninfected adults are exposed to filarial infection, there follows a symptom-free period of variable duration, depending upon the quantitative degree of infection and the response of the host to the parasite (*5*). In certain individuals (47 percent of this series), symptoms such as lymphangitis and lymphadenitis,

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with transient swelling of affected parts, then occur. Repeated acute episodes of this kind may occur without causing permanent damage. In some persons, however, who are subjected to repeated reinfection and who perhaps offer less effective resistance to the parasite, swelling of an extremity recedes less following each acute episode, and eventually progresses to an irreversible stage of anatomic and physiologic change.

Four of the 11 males showing enlargement of extremities had experienced genital involvement during the course of the disease, and three had had local operation for hydrocele, but had no current genital symptoms. The rather low incidence of genital involvement in the group, compared with that seen in some groups of service personnel (*6*), may be due in part to the fact that such symptoms are apt to be viewed with alarm and therefore are cause for withdrawal from the area if feasible.

The incidence of elephantiasis in the group as a whole is not low, but it should be kept in mind that these individuals received their exposure, for the most part, in a period during which the epidemiology of the disease was obscure, and mosquito control in a majority of instances was limited to the use of a sleeping net, which, of course, is ineffective against the vector. The absence of appreciable elephantiasis in the professional-clerical occupational group, which on the whole received least contact with the native reservoir of infection, seems significant. The widespread interest in filariasis occasioned by the recent war should lead to more effective preventive measures, particularly with respect to elimination of the reservoir of infection and eradication of the vector, perhaps to specific therapeutic agents, and in any case to a more favorable prognosis among white immigrants in the area.

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ASYMPTOMATIC MICROFILARIEMIA IN THE CARIBBEAN AREA

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and
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Lieutenant (MC) U. S N. R.

It has been stated (*1*) in a study of filariasis occurring in military forces in the Samoan group of Pacific Islands that "several thousand thick and thin smears taken at various intervals during both day and night hours have proved to be negative for microfilariae." Even massive concentration methods have failed to demonstrate microfilariae in the peripheral blood of U. S. Navy and Marine personnel who present definite filarial signs and symptoms. The findings of microfilariae in the smears of noctural blood samples of nine Naval personnel, who were devoid of signs or symptoms of disease, stimulated a review of the relationship of microfilariae to filarial disease.

The patients were nine Negroes, between 19 and 29 years of age, who were sent to a Naval dispensary in the Caribbean area for examination for the possibility of filarial infection. All had served at least 1 year as steward's mates in the U. S. Navy. They were natives of St. Croix in the Virgin Islands. Filariasis has been known to exist in these islands since 1844 and is believed to have been brought there by immigrating Negro slaves. It is estimated (*2*) that 40 to 50 percent of the natives of that area have filarial infection.

Interrogation as to signs or symptoms of lymphangitis, lymphadenitis, elephantiasis, abscess, scrotal involvement, lymph varix, and abdominal or testicular disease, revealed no positive history. None of the patients knew of the term filariasis, though all had seen examples of elephantiasis. Family history was uncertain but no gross elephantiasis was admitted as occurring among relatives.

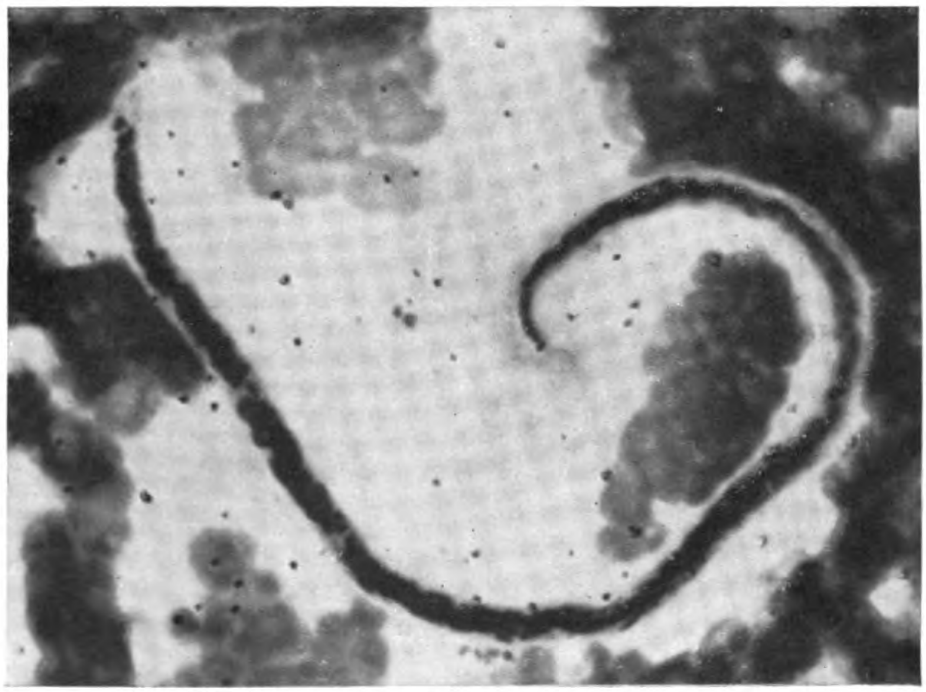
Physical examinations were completely negative in all except one patient, in whom a few pea-size nodes were present in the left inguinal region. These nodes were no larger than those occasionally discovered in routine examination in nontropical countries.

Erythrocytic and total leukocytic counts were within normal limits. In the five differential counts performed no significant increase in eosinophils was noted, and the lymphocyte percentages were 38, 42,

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42, 45, and 46. O'Connor and Hulse (*3*) found a lymphocytosis in seven patients with asymptomatic microfilariemia. Blood Kahn and urine tests were negative. Temperature, pulse, respiration, and blood pressure were all within normal limits.

Both the unstained wet and the stained thick and thin smears for microfilariae were done on fresh blood samples. Giemsa and Wright stains were employed. The Knott blood concentration technic and a modification of it were used. All patients showed microfilariae in many blood smears. The microfilariae (figs. 1 and 2) were sheathed, the caudal cells did not extend into the tip of the tail, and the neural commissure and excretory pore were in the position characteristic of Wuchereria bancrofti.[1] Positive findings were obtained



1. Microfilaria (Wuchereria bancrofti) in thin smear. X 1,500.

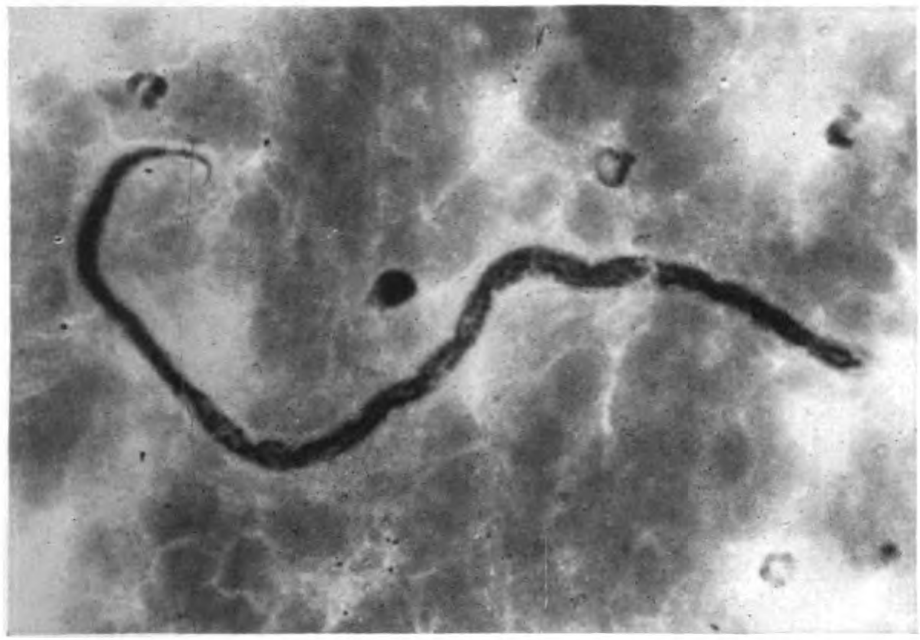
in blood samples drawn during the hour from 2300–2400. Blood specimens taken at 1000, 1200, 1400, and 1800 were negative. Concentrated sediment of urine collected at the same time as the positive blood samples did not reveal the parasite.

Subsequent to the finding of microfilariae the patients were given medical discharge from the service.

Technic.—Fresh unstained blood smears did not reveal the parasite in any of our cases. Routine thin smears stained with Wright

[1] We are indebted to Dr. Ernest C. Faust, Professor of Parasitology, Tulane University of Louisiana School of Medicine, for his kindness in viewing the slides and confirming the diagnosis of Wuchereria bancrofti microfilariae, and to Mr. B. B. Varian, Department of Anatomy, University of Pennsylvania School of Medicine, for the photomicrographs.

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2. Microfilaria (Wuchereria bancrofti) in thick smear. X 1,100.

stain showed the parasites in five cases. Thick blood smears taken between 2300 and 2400, and stained with Giemsa stain as for malarial parasites, revealed the microfilaria in seven cases, including the five positive by thin smear. Using a modification of Knott's concentration technic, 2 cc. of venous blood taken from 2300 to 2400 were placed in a centrifuge tube with 10 cc. of 2-percent formalin solution and the tube was centrifuged at 2,000 revolutions per minute for 5 minutes. Smears were made of the sediment and stained with Giemsa or Wright stain. Blood from two patients stated to have been negative when examined by other methods, showed microfilariae repeatedly when the concentration technic was used. This latter method consistently demonstrated microfilariae in single blood examinations, whereas other methods required multiple examinations before a positive slide was found.

These findings are consistent with the general experience that the concentration technic yields a higher percentage of positive smears than does the thick or thin smear alone. Knott (*4*), in a study in Puerto Rico, found a general incidence of microfilariae of about 40 to 50 percent in adults by use of concentration methods. Other studies in the same areas by routine smears showed a general incidence of from 10 to 30 percent (*2*).

The disease filariasis had been recognized by the ancient Hindus and Persians, but microfilariae—the larval form of the filarial nematode Wuchereria bancrofti believed to be the cause of the disease—were first described by Demarquay (1863) in Paris who saw them in the hydrocele fluid of a patient. In 1865 Wucherer (Brazil) demon-

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strated their presence in chylous urine. Lewis in India (1872) was the first to describe the microfilariae in the peripheral blood and lymph. The adult female worm was first described by Bancroft (1876). Manson (1878) showed that the mosquito Culex fatigans was the intermediate host, and first reported on the nocturnal periodicity of microfilariae.

Manson-Bahr (1912) in his studies in the Fiji Islands showed that the aëdes mosquito was an important vector in that locality and that there was no noctural periodicity to the microfilariae in the blood of the natives. In 1927 Brug described a similar yet separate species of nematode, Wuchereria malayi, that is more common in the Pacific area. Since then it has been almost universally accepted that there is a causal relationship between the disease filariasis and the presence of Wuchereria bancrofti or Wuchereria malayi.

Life cycle in the human.—Relatively little is known of the life cycle of microfilariae in humans as compared to the well-known development in mosquitoes. For although symptoms of the disease may appear in persons from nontropical regions within a few months after arrival in a filarial district (*7*), it is believed that it takes about 1 year after a successful inoculation for microfilariae to appear in the peripheral blood (*5*). In corroboration of this belief Anderson (*8*) reports a case of microfilariemia in a 14-month-old child. The microfilaria of Wuchereria malayi has been reported (*9*) as occurring in the blood of a child under 1 year of age. This necessary period of development may explain the negative blood smears in the Samoan group.

The duration of the life of the larva once it reaches the blood stream has also led to much speculation. Myers believed that the life of the parasite was measured in hours, Sonsino in days, and Bancroft in months, according to Rao (*10*). This last author studied 2 patients with microfilariemia in each of whom a single cyst was believed to contain the adult worms giving rise to the blood stream larvae. Excision of both cysts was performed and repeated blood smears were examined. In one patient microfilariae persisted in the blood stream for 70 days and in the other the larvae disappeared between the second and third months after excision of the cysts containing the adult worms. Only negative smears were obtained in both patients thereafter. Knott transfused a noninfected patient with microfilariae (Wuchereria bancrofti) and was able to recover viable organisms from the patient for 14 days (*11*). Microfilariae can be kept alive in the laboratory outside of human or mosquito hosts for 4 to 6 weeks (*10*).

COMMENT

One of the perplexing aspects of the disease filariasis is the often demonstrated presence of microfilariae in the peripheral blood of

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tropical natives who show no signs and have no symptoms of the disease (as in our cases), and the absence of microfilariae in patients with filarial symptoms (Samoan cases). Naturally the question has arisen as to whether the larval form found in the blood stream is a disease-producing agent, a saprophyte, or a true indicator of the presence of the adult worm in the human tissues.

In the Philippine Islands, where 15 to 20 percent of the inhabitants show microfilariae in the blood stream, it is rare to observe symptoms or signs of the disease. In Puerto Rico, Hoffman et al. (*12*) examined 4,590 natives and found evidence of filarial infection in 483. Of these, 208 had clinical manifestations of filariasis and 275 had microfilariae in the peripheral blood. Only 14 had both demonstrable microfilariae and clinical manifestations. Iyengar (*13*) reported on the blood smears of 31,005 persons in Trivandrum, India, and concluded that the incidence of positive blood smears for microfilariae among the various manifestations of the disease varied *inversely* with the duration and severity of the disease. Deserving comment is the variation in clinical signs of filariasis from country to country. Elephantiasis is very prevalent in Georgetown, British Guiana, common throughout the tropics, yet rare in Saigon. Hydrocele is exceptionally common in Puerto Rico, yet of minor significance in certain sections of India. Chyluria and lymph varix are very common in Allahabad, but rare in the rest of the filarial world. Regions of the same country and even regions of the same city differ considerably in clinical signs and symptoms of what is presumed to be the same disease (*14*).

Because of these seeming discrepancies there has been postulated an important role for bacteria as the causative agent in the filarial syndromes of an inflammatory nature. Acute lymphangitis, lymphangitis-elephantoid fever, and abscess formation associated with filariasis have been ascribed to pyogenic infection, especially by the beta hemolytic streptococci (*15*) (*16*). McKinley (*17*) was unable to substantiate these claims in a careful bacteriologic study of 48 cases of acute lymphangitis. Lymph node biopsies by Zuckerman and Hibbard (*18*) in early filariasis in the Samoan service cases revealed no histologic evidence that bacteria were responsible for the lymphangitis. O'Connor from his studies in Puerto Rico believes that the parasite, or the toxic byproducts of its degeneration, per se, may give rise to the inflammatory reactions of the disease although he admits that in chronic cases secondary infection may play a part.

The relationship of microfilariae to the obstructive phenomenon of the disease is of note. Anderson (*8*) found in British Guiana that of 434 patients with elephantiasis only 42 (9.6 percent) showed microfilariae in blood smears. Iyengar's (*19*) study of more than 4,000 people, including over 500 cases of elephantiasis, demonstrated an

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incidence of microfilariemia three times as great in persons without clinical evidence of filariasis as in those with elephantiasis. Acton and Rao (*14*) found an incidence of microfilariae of 14.7 percent in an asymptomatic group in India, but in this area those with elephantiasis showed an incidence of only 5.7 percent. O'Connor studies showed similar results. Because of this lack of any clear-cut causal relationship between blood stream microfilariae and elephantiasis, it has been postulated that the adult worms or microfilariae growing in the lymphatics plug up these channels, cannot reach the blood stream, and thereby give rise to obstruction and subsequently to filarial signs. However from a study of 14 cases of elephantiasis that came to autopsy, Anderson (*8*) states, unequivocally, "In no dissection of elephantoid tissue was there ever any evidence of occlusion of lymphatic channels by filariae living or dead."

The low rates of microfilariemia in the severe obstructive lesions and the lack of evidence to show mechanical blocking of lymphatics by the parasite would suggest some general reaction on the part of the host tissue that causes the destruction of the worms. Because of the presence of edema and eosinophils in the acute inflammatory reaction about dead or dying worms, it has been postulated that the inflammation is an allergic reaction to substances released through the process of degeneration. Acton and Rao (*20*) have reported marked urticaria in filaria patients, as have others. Although attractive as a hypothesis and suggestive pathologically (*1*) (*3*) (*18*), there has been little objective confirmation of the allergy theory.

In spite of many discrepancies it is generally accepted that there exists a causal relationship between the adult worm or its larva and the disease filariasis. In 2 reports in which a total of 35,000 people were studied, Iyengar (*13*) (*19*) found a high positive correlation coefficient between the microfilarial rate and filarial signs and symptoms. To explain this fact and to correlate it with the varied pattern of the disease Acton and Rao (*14*) have advanced an illuminating hypothesis. They found from a study of 6 cities of India (Allahabad, Cochin, Puri, Cuttack, Calcutta, Purulia) that these areas could be divided into 3 types on the basis of the endemicity of the infection as determined by the microfilarial rate (using nonconcentration methods). They classified those areas as highly endemic where an incidence of 20 percent or over existed, moderately endemic where the rate was 10 to 20 percent, and low endemic where the incidence of microfilariae was under 10 percent of the population. When such groups were studied it was found that each had certain definite characteristics. In a highly endemic area (Cochin) the age of onset of microfilariemia was quite young (5 to 10 years); the inflammatory lesions of lymphangitis, elephantiasis, and abscess formation were

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very prevalent; and chyluria or hydrocele was rare. In contrast in a low endemic area (Allahabad) the age of onset of microfilariemia was much later (18 to 25 years); the most common lesions were hydrocele, chyluria, and lymph varix; and elephantiasis of the scrotum and extremities was very rare. In the moderately endemic areas the age of onset of microfilariemia was midway between the 2 groups (10 to 15 years), and the lesions were a combination of the 2 distinct types, with both the hydrocele and chyluria of the low endemic group and the elephantiasis of the highly endemic group present in the same area.

Previous studies (*21*) showed that the optimum temperature and humidity for the development of the filarial larva in its intermediary host in India, the mosquito Culex fatigans, was a temperature from 80° to 90° F., and a relative humidity of 60 percent or over. In the highly endemic areas such conditions were present from 6 to 8 months of the year, in the moderately endemic areas for 4 or 5 months, and in the low endemic areas for only a month or two. Also of importance was the simultaneous occurrence of the proper conditions—rainfall and appropriate breeding places—for the mosquito vector during the optimum period of temperature and humidity. These were generally most suitable in the higher endemic areas, and least so in the low endemic areas.

In their interpretation of the characteristic manifestations of the disease in India, Acton and Rao stress the anatomy of the lymphatics of the lower limbs and pelvis, since most of their cases had these regions affected. The peripheral lymphatics of the lower limbs drain into the inguinal glands, which empty into the iliacs (external and internal), thence to the common iliac glands, and finally through the aortic (lumbar) glands to the thoracic duct. The important factor is that the lymphatic drainage of the testicles and scrotum is different from that of the extremities, although efferents from both empty into the lumbar groups. In a highly endemic region (Cochin) there is overwhelming infection, and the severe inflammatory reaction set up in the peripheral and inguinal regions results in lymphangitis, lymphatic obstruction, and eventually, with repeated acute attacks, elephantiasis of the lower extremities. In the moderately endemic regions the fewer parasites set up inguinal and peripheral reactions which are not so severe and many of the parasites are able to migrate farther up the lymphatic vessels to the juxta-aortic group of nodes. Inflammatory changes in these nodes affect the lymphatic channels draining the scrotal and bladder regions. Thus in the moderately involved areas there is seen chyluria and hydrocele as well as some elephantiasis of the lower extremities. In regions of low endemicity

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very little reaction is set up in the inguinal or peripheral lymphatics because of the relatively few parasites.

Anderson's work in British Guiana tends in general to corroborate Rao's observations, for there the general rate of microfilariemia is high, the age of onset of the infection is early, and the most common manifestations are elephantiasis, lymphangitis, and adenitis. Hydrocele, lymph scrotum, and chyluria were infrequent. O'Connor's studies in Puerto Rico, where the main lesions are lymphangitis, adenitis, elephantiasis, and hydrocele, are consistent with these results, although the last lesion is at variance with a highly endemic area but does occur in moderately endemic areas. In a report (*22*) of 254 cases of chyluria from India it was stated that this manifestation was confined to low endemic areas. It would seem that Rao's explanation holds true in general, although variations in local conditions, such as temperature, humidity, possible breeding places for mosquitoes, amount of contact with carriers, type and infectivity of mosquitoes, the occurrence of maximum mosquito breeding rates in relation to optimum temperature and humidity, personal sanitation, and customs of the country, would greatly influence the rate of acquisition of microfilariae and subsequently the manifestations of the disease.

Our cases well illustrate what occurs in natives of the tropics so frequently, namely, the repeated infection with filarial parasites in a person who may remain entirely normal otherwise as far as examination can decide. The importance of these people as potential sources of infection to others is patent and since there are no drugs known at the present time that will destroy the adult worm or the microfilariae, they should be discharged from the service in the tropics. The examination of natives, from areas known to be endemic foci of the disease, who come into contact with service personnel should obviously include examination of blood smears taken at appropriate times and by concentration methods for the detection of microfilariae.

SUMMARY

Nine natives of the Virgin Islands who were serving as steward's mates in the U. S. Navy were found to have blood smears demonstrating microfilariae. All were asymptomatic, had negative past histories for filarial infection, and no positive signs on physical examination.

The relationship of the presence of microfilariae in the peripheral blood to filarial signs and symptoms is discussed. The need of efficient concentration technics in examining blood for the presence of microfilariae is emphasized.

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PAGET'S DISEASE OF THE NIPPLE

The Paget cell develops from the normal epithelial cell. It has the same structure as the so-called vacuolated cells of carcinomatous ascites and pleural fluid and the cells of tar cancer. The changes which characterize the Paget cell are not the product of degeneration or of fixation, or a peculiar type of intracellular edema or a disturbance of glycogen metabolism or vacuoles. The Paget cell is not a misplaced embryonal germ cell or a nevus cell or a melanoblast. Whether the Paget cell is, according to L. Savatard (1935) and other authors, already a cancer cell is a question which cannot be answered satisfactorily, as cells of the type of Paget cells are not specific for Paget's disease only. The process occurring in the Paget cell is a normal response of the epithelial cell toward different kinds of animate and inanimate stimuli, among which are tar, x-rays, sunlight, viruses and the unknown causes of cancerous conditions, psoriasis and lichen planus.—MEIROWSKY, E., and KEYS, S.: Paget cell; its structure, occurrence and significance. Proc. Roy. Soc. Med. 38: 495–498, July 1945.

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EYE DAMAGE IN TSUTSUGAMUSHI

The hemorrhages found in the subconjunctiva and retina probably arise from minute areas of vasculitis with damage to vessel walls and consequent leakage of blood. In the formation of retinal hemorrhages some degree of back pressure is probably also a factor, for marked venous engorgement is found in some, and many have some degree of back pressure on the retinal veins. The cause of this is doubtless the cerebral and meningeal congestion known to occur, and the papilledema found in some can be similarly explained.

The optic atrophy and the associated loss of the visual periphery is interesting and its cause difficult to determine. The rapid and fairly complete initial loss, and the extent of recovery favor a toxic origin. The shelving nature of the edge of the seeing area suggests that some further recovery would have taken place, but, as remarked, no change was noted after an interval of 2 months.

In considering the optic atrophy, it is interesting that a considerable number of cases of scrub typhus develop a nerve deafness. It is odd that this nerve should be singled out, and as in the case of the optic nerve, the cause may be a toxic one.—MACASKILL, J.: Some ocular complications of scrub typhus. Brit. J. Ophth. 29: 537–540, October 1945.

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ACUTE INFECTIVE JAUNDICE (ACUTE HEPATITIS)

OCCURRENCE AT A NORTH AFRICAN BASE HOSPITAL

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Acute infective jaundice as a disease of military significance has achieved increased prominence during the past few years. In the Mediterranean area among the British forces (*1*) it was second in importance to malaria and venereal disease. Havens (*2*) has given an account of its occurrence among U. S. Army troops in the Middle East, while Willard (*3*) and Simpson et al. (*4*) have respectively reported outbreaks reaching epidemic proportions among U. S. Naval, Marine, and Army personnel in the South Pacific theater. Havens and Willard, as also Cohen (*5*), have emphasized the long period of hospitalization required in the average case, which has made the disease an important military problem.

It is therefore felt that a review of 70 cases, several of which present unusual features, occurring during a 15-month period at a North African base hospital, would be of interest.

The patients discussed in this paper were admitted from Naval vessels in northwest African waters or from shore stations and small Army posts within a 30-mile radius of the hospital. Fifty-six (80 percent) were Naval personnel divided equally between ship and shore, while the remainder were composed of Army patients (12 American and 2 British). All of our patients were males of an average age of 24 years.

Seasonal incidence.—The accompanying graph shows the seasonal fluctuation of our cases, which rose abruptly through October and November and reached their highest peak in December 1944, and then fell sharply through January and February of 1945. Havens in his series (200) noted a somewhat similar distribution, although his highest levels were reached in the months of November and January. In the South Pacific the disease was reported as most prevalent during April and May.

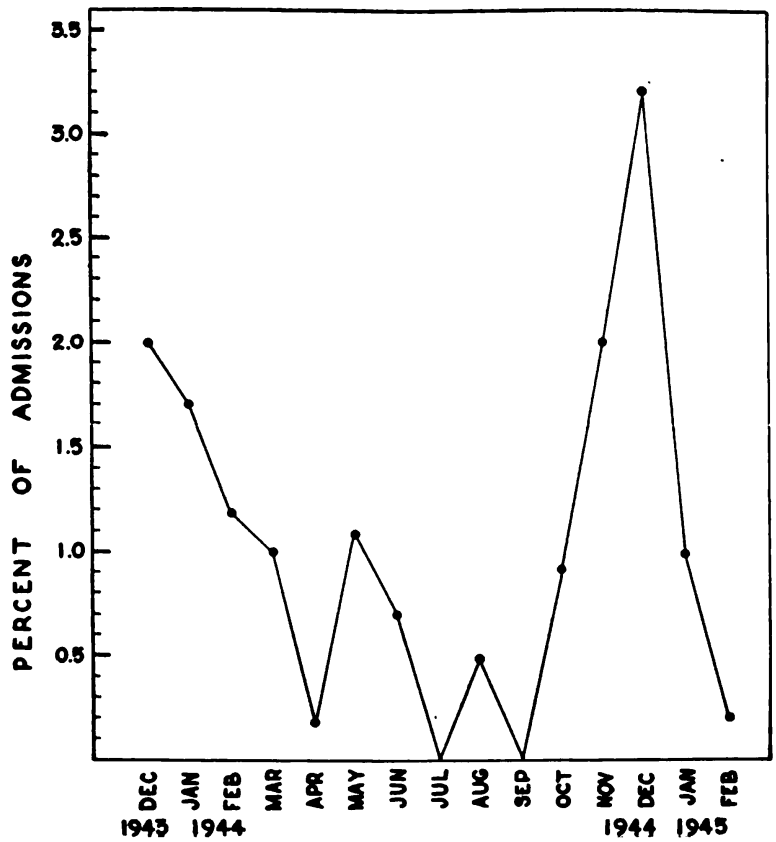
Clinical course.—According to the history obtained, the onset in the majority of cases was a gradual one. For several days the patient

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continued to carry out his duties although feeling "below par;" then anorexia, upper abdominal discomfort, nausea, vomiting, and malaise, in the order named, were the most frequent symptoms of which he complained. Finally icteric sclera and skin, or pronounced biliuria resulted in the patient being referred to the hospital for admission. In the remainder the disease began abruptly with chills and fever. Insomnia, vertigo, diarrhea, and constipation were relatively infrequent symptoms in our series.

Physical examination on admission revealed all our 70 patients as having evidence of clinical icterus. Fever varying from 99° to 102° F. was present in 27. Twenty of these exhibited tenderness in the liver area on palpation, 15 a large and tender liver, 11 an enlarged liver without tenderness, and in 1 case both liver and spleen were palpable.

Practically all our patients had an uneventful hospital course. Those admitted in a febrile state generally had a normal temperature within 3 or 4 days following admission. The average patients, prior to admission, had been ill 8 days, including 2 days of clinical icterus, and were hospitalized for 27 days before being discharged to full duty. Usual duration of illness, counting from the day the patient first noticed symptoms until discharge date, was 35 days. The mean period



Relative seasonal incidence of acute infective jaundice in percentage of total admissions.

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of jaundice was 30 days, upper and lower limits being 79 and 11 days.

In a number of patients, as the icterus index rose and anorexia became more pronounced, upper abdominal discomfort was a troublesome symptom. However in others the anorexia and gastric distress were out of proportion to the degree of jaundice. Pruritus was present in only four cases and then in a mild degree, while bradycardia was not observed. Vomiting seldom occurred, even at the height of the disease. There were no complications in this series.

Laboratory findings.—The icterus index was observed routinely. In our series it averaged 53 mg. percent, the lowest being 12 and the highest 170. The van den Bergh test was performed on a small group of patients (17) but yielded no pertinent information. No anemia was noted. The average leukocyte count was 6,640, with an average mononuclear count of 3 percent. The lowest count was 2,700 and the highest 11,700, while the mononuclear cells ranged from 1 percent to 14 percent.

Biliuria was present in most of the cases. Havens and others have emphasized the diagnostic importance of bile in the urine in the preicteric stage; i. e., when clinical icterus is not present. Transitory albuminuria was found in a small number of our cases but appeared to be of no significance as to the prognosis. Kahn tests performed on 42 patients were negative. Liver function tests were not practical with the facilities available.

Treatment.—Treatment consisted of a high carbohydrate, high protein diet with 5 gm. of liver extract orally thrice daily. Although the latter caused abdominal distress in a few of the patients, it was in the main well tolerated. Intravenous dextrose, 50 cc. of a 50-percent solution or an occasional infusion of 1,000 cc. of 5-percent dextrose in saline, was only given in those cases in which severe anorexia threatened the patient's nutrition. A high degree of jaundice in itself was not used as an indication for this procedure. Several patients whose icterus index remained below 40 were given dextrose intravenously, while others whose readings rose to 80 or above maintained a good appetite throughout their hospital stay.

Patients were kept in bed until the icterus index was 20, and were discharged to full duty when it fell below 10. As far as could be determined, none of our patients suffered a relapse. Nine patients with an icterus reading of 100 or above, and 1 patient with a recurrence, were considered to have the disease in such a severe form that their convalescence would be longer than 3 months; therefore they were evacuated to the United States for further treatment and disposition.

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Differential diagnosis.—Since the patients were admitted in the icteric stage, the diagnostic problem for the most part was a simple one. However several cases with histories of fulminating onset characterized by chills, fever, and pronounced abdominal discomfort with tenderness, suggested obstructive jaundice or a possible surgical abdominal emergency. The young age of the patient, lack of history of gallbladder colic, absence of pruritus and bradycardia, together with a low leukocyte count, tended to rule out regurgitation jaundice. Elevated icterus index, biliuria, lack of abdominal rigidity, and the approximately normal leukocyte and differential counts found in infective jaundice, usually eliminated any surgical consideration. In an occasional patient with a history of malaria, that disease was discounted by negative smears and by absence of a palpable spleen or splenic tenderness.

One of the most unusual problems of diagnosis encountered was a case of infectious mononucleosis which was characterized clinically in the early stage by fever, jaundice, palpable liver, absence of a generalized lymphadenopathy, and by an icterus index of 30 which receded to normal in 2 weeks. The total leukocyte count was within normal limits. However the differential blood smear showed a predominance of the typical large lymphocytes which characterize the disease. Several heterophil antibody tests taken during the course of the disease were negative. Three months later a suggestive positive heterophil reaction was noted (1:28), and a differential blood smear showed the persistence of a relative lymphocytosis. Several control agglutinations performed on the infective hepatitis cases were entirely negative.

A second case already diagnosed on the basis of the presence of characteristic cells in the differential count and a positive heterophil antibody test (1:448), developed clinical jaundice, with a slightly palpable liver and spleen on the twenty-sixth day of the disease. The icterus index in this patient was fourteen.

De Vries as cited by Spring (*6*) has described several cases of this entity in which jaundice was one of the first symptoms of the disease. Halcrow et al. (*7*) have mentioned 8 "severe cases" out of their series of 202 as having a "latent jaundice" as indicated by positive icteric index and van den Bergh reaction.

The differential diagnosis between acute hepatitis and infectious mononucleosis characterized by jaundice can generally be made accurately by examination of the blood smear. A differential count showing a relative lymphocytosis (characteristic large lymphocytes) would be strongly in favor of the latter disease. A positive heterophil antibody test which occurs in approximately 80 percent of the cases of infectious mononucleosis is an additional diagnostic aid, although

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it may not occur till late in the disease. Clinically generalized lymphadenopathy and a palpable spleen also suggest this disorder.

Recurrence.—Recurrence of epidemic hepatitis is not frequent. Witts states that 2 percent of the patients may have a second attack. Gordon (*8*) in his 168 cases had 6 patients with a history of one or more previous attacks. One of our patients gave a history of being ill with the disease 10 months previously. His second attack was of marked severity and necessitated evacuation to the United States.

Distribution.—In our series there was 1 shore station, with a complement of 1,300, which had 8 cases occurring during the period covered by this survey, and which because of the comparatively permanent nature of the personnel is worthy of analysis from the viewpoint of epidemiology.

The first patient from this activity was admitted on 3 December 1943, followed by a second 36 days later, and no further patients with acute hepatitis were received during a subsequent 7-month period. Then 5 cases occurred during the last 6 months of the study, at average intervals of 23 days. Two of these patients were admitted during a 4-day epidemic of dysentery (shigella), later traced to food handlers, and affecting 120 men. The remaining 3 jaundiced patients of this group were admitted at intervals of approximately 8, 66, and 30 days. Neither of the patients admitted during the dystentery outbreak had diarrhea as one of his symptoms, nor did he have a history of having had a recent attack of the disease.

Seven patients were received from another shore activity during the period covered by this paper, but because of the transient nature of its personnel (receiving station), it was felt that no accurate observation on causation could be made, and its cases were therefore not analyzed. No other shore unit in this area presented similar groups meriting study.

Two ships, each with a moderate complement, had four and three cases respectively, with an average of 7 days between the cases of the first ship, and a 1-day interval between those of the second.

There were 18 smaller ships which referred only 1 case each. The majority of these vessels were operating in local waters several months before and after their respective cases were diagnosed, and any subsequent patients with the disease would probably have been referred to the hospital for admission.

Two cases of this series occurred among the hospital staff. One was that of a pharmacist's mate who never had any contact with our jaundice patients. The other occurred in a chief laboratory technician who performed all the stool examinations for the clinical pathology service.

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Every patient admitted to the hospital with jaundice was placed on a separate "jaundice ward." No special isolation technic was practiced and personnel working there followed only the ordinary hygienic procedure of washing their hands after handling the excretions of the patients and before going to meals.

It is believed by some (*5*) (*9*) that a virus is the probable causative agent of infective jaundice. The portal of entry may be through the upper respiratory passages (*11*) or via the gastro-intestinal tract (*10*). Transmission may occur by droplet infection in the pre-icteric phase of the disease (*10*) and possibly by infected intestinal discharges during any stage (*9*) (*10*). "Inapparent cases" and "subicteric cases" are believed by Gowen to be a factor in its spread. Gezon has suggested that carriers of the disease may exist. Outbreaks of dysentery or gastro-enteritis preceding epidemics of this disease have been credited with significance by at least one writer (*11*), but this view has not been shared by others (*3*) (*9*).

Willard has pointed out that some of the predisposing factors appeared to be lowered resistance, repeated gastro-enteritis, prolonged taking of atabrine, and poor hygiene and sanitation. Sapero and Butler (*12*) mention combat fatigue and exhaustion.

The average incubation period has been generally accepted as 30 days. It has been stated that one of the characteristics of an epidemic is a "herald case" (*1*) which precedes by 2 weeks an explosive outburst.

No definite principles have been suggested for the control and prevention of infective jaundice. The efficacy of isolation in preventing the spread of the disease has been questioned because of the prevalence of subclinical cases.

COMMENT

Comparison of this series with others reported from the Middle East, North Africa, and from the South Pacific area reveals little difference in symptoms, physical signs, course, severity, and period of hospitalization.

Dysentery in this area does not seem to be a predisposing factor, as an epidemic at a large shore activity was not followed by a great increase in cases of recognizable acute hepatitis.

The seasonal variation in this series, with the greatest incidence during the months when flies are not prevalent here, would tend to rule out insects as a factor in the spread of the disease.

The small number of cases (56) occurring among Naval personnel in this area over a comparatively long period (15 months), when large groups of men were being concentrated for major amphibious operations, suggests that good hygiene and sanitation played a large role in keeping the disease in check. Combat fatigue and exhaustion were

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other factors whose absence also probably favored the low incidence. Atabrine was not routinely given prophylactically.

The failure of any of our hospital staff, working on the jaundice wards, to develop the disease, indicates that the practice of ordinary hygienic procedure by personnel caring for patients or handling their excretions will prove adequate in preventing their contracting the disease.

The recent work of Stokes and Neefe (*13*), using gamma globulin to "prevent and attenuate" this disease, suggests that possibly in areas where troops in the field are subject to poor hygiene, exhaustion and combat fatigue, this agent might be valuable in quelling outbreaks of infective jaundice.

SUMMARY

A series of 70 cases (56 Naval) of infective jaundice seen during a 15-month period (December 1943 to March 1945) at a North African base hospital has been presented. The epidemiology and predisposing factors of the disease have been discussed.

Our experience suggests that ordinary hygienic procedures carried out by a hospital staff give them adequate protection when caring for patients suffering from the disease.

The occurrence of only 56 cases among Naval personnel, during a time when large groups of men were being heavily concentrated in the area for major amphibious operations, is a strong indication that high standards of hygiene and sanitation, and lack of combat fatigue and exhaustion were important factors in maintaining this low incidence of the disease.

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EPIDEMIC HEPATITIS IN A COMBAT ZONE

The icterus index is not a reliable guide in determining either the activity of hepatitis or the degree of hepatic functional impairment following an attack of epidemic hepatitis. That is, the degree of icterus does not always indicate the severity of hepatic damage. The icterus index is, however, useful in following the course of the disease. The hippuric acid test of hepatic function frequently indicates residual hepatic functional impairment long after the icterus index has returned to normal. Also the sedimentation rate is useful in determining the residual activity of the hepatitis and frequently remains elevated for several weeks after the icterus index has returned to normal.

These conclusions were drawn from observations on 238 unselected patients with hepatitis and jaundice seen in an Army general hospital in Italy over a 6-month period. An additional 17 patients having hepatitis without jaundice were studied. All cases were verified by various clinical and laboratory methods. An icterus index of at least 16 was arbitrarily set as the lower limit indicating the presence of jaundice; milder forms of the disease were thus excluded. There was one death in the series.

The clinical characteristics of epidemic hepatitis with jaundice were found to be not essentially different from those of catarrhal jaundice. Clinically it is similar to postvaccinal hepatitis, but differs in the frequent occurrence of chills, fever, and lymphadenopathy, and in the relative absence of dermatitis, anemia, and mental reactions.

Epidemic hepatitis is frequently a serious disease which by its seemingly benign course may mislead both the patient and clinician. A prolonged convalescent period and conservative management are important in treatment.—FINKS, R. M., and BLUMBERG, R. W.: Epidemic hepatitis with and without jaundice; some clinical studies on 255 patients among troops in a combat zone. Arch. Int. Med. 76: 102–113, August 1945.

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TREATMENT OF BATTLE CASUALTIES RESULTING FROM A DIVE-BOMBING ATTACK ON AN ESSEX-CLASS CARRIER

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An enemy plane making a dive-bombing attack struck the after portion of the island structure of this Essex-class carrier, causing a bomb explosion and fire. Forty-one persons were killed outright and 141 were injured. Of the latter, 9 died within 72 hours. How the medical problem was handled is discussed here.

As soon as the military situation permitted, medical personnel from nearby battle dressing stations went to the island structure to supervise first-aid treatment of the injured and direct members of the crew in their evacuation. Later additional medical personnel were sent from more distant battle dressing stations upon the order of the medical officer. Because of the large number of casualties, much of the first aid was given by members of the crew, who applied basic instruction admirably in treating and in evacuating the wounded before the arrival of medical personnel. First-aid measures consisted in covering burns with boric acid ointment and gauze dressing, applying sulfanilamide powder to wounds, application of a tourniquet when necessary, and the administration of morphine and other measures aimed at lessening the discomfort of the patient.

Most of the patients were moved to the sickbay in metal stretchers, and probably for this reason very few splints were applied to fractures by those rendering first aid. Although the crew had been instructed in the use of splints, in the confusion and excitement they neglected to use those provided in the first-aid boxes for upper extremity fractures. Nevertheless patients arrived at the sickbay with bony fragments in good position, and so far as could be determined suffered no ill effects from the lack of splints. The rigid Stokes litter provided excellent support for fractured extremities because of its firm con-

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struction. At battle dressing stations Nos. 1 and 4, some patients were given blood plasma, and minor operative work, such as ligation of bleeding vessels, was performed.

After approximately 30 minutes, "condition Baker" was set, which permitted the movement of the injured to the sickbay through the opening of the watertight doors. Almost all injuries were incurred in the island structure. The evacuation of the injured from this area was accomplished by several means. Most of the stretcher patients were carried down ladders within the island structure, while some were lowered directly to the flight deck by lines attached to the corners of the stretcher. From the flight deck some were taken to No. 1 battle dressing station and later lowered to the hangar deck by a Stokes stretcher rigged with a single block and tackle installed prior to the engagement. Others were moved to the hangar deck by No. 2 deck elevator, and then aft to the sickbay via hatch at frame 153, starboard side. Many were moved by the use of the bomb elevator, particularly No. 2 bomb elevator, using a special procedure also previously developed. By this route it was possible to evacuate patients directly to the sickbay level on the third deck, permitting the entire procedure to be accomplished with the patient in a horizontal position, a desirable factor in the case of the seriously injured.

When patients had arrived at the sickbay, all medical personnel aided in giving definitive treatment. A call for volunteer assistants brought many crew members whose services elsewhere could be spared. These men were used as special observers to report on the comfort of the patients, watch the flow of blood plasma, assist the hospital corpsmen in feeding helpless patients, and for general help in the wards. Their services were invaluable. The advantage of having all patients in one area near the sickbay was soon apparent when definitive treatment was begun.

Classification of injuries.—Table 1 presents a classification based on the principal injury. Nine of the 141 wounded died later of their injuries; of these, 5 were burned, 3 of whom died within 6 hours and 2 of whom lived 3 days. The remaining 4 patients died of wounds. Of these, 2 lived only 2 hours; the other 2 lived 11 and 18 hours, respectively. In nearly every instance burns of some degree and extent were present in those listed as wounded. Classification according to principal injury fails to indicate the prevalence of burns. According to prognosis, 13 patients were classified as critical, 24 as serious, and 104 as favorable.

Burn cases are further classified in table 2 according to degree and percentage of body surface involved and in table 3 according to parts of the body involved.

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TABLE 1.—*Classification of total casualties based on principal injury*

Total casualties	Number cases	Percentage	Injured (percent)	Died	Mortality rate, treated cases (percent)
Killed or missing	41	22.5			
Injured	141	77.5			
Total	182	100.0			
INJURED					
Burns:					
First degree	4				
Second degree	77				
Third degree	8				
Total burns	89	49.0	63.0	5	5.6
Wounds:					
Lacerated	2				
Punctured	29			3	
Amputations, traumatic: Hand, 1; arm, 1; leg, 1	3				
Fractures, compound: Arm, 1; legs, 5; both, 1	7				
Injuries, multiple, extreme	2			1	
Blast concussion: Chest, 1; abdomen, 1	2				
Foreign body, eye	1				
Rupture, tympanic membrane	1				
Contusions	5				
Total wounds	52	28.5	37.0	4	7.7
Total injured	141	77.5	100.0	9	6.4

Note that burns of the face, arms, and hands occurred in 95 percent of cases, while burns involving other parts of the body only, occurred in 5 percent of cases.

TABLE 2.—*Incidence of burns according to degree and extent of body surface involved*

Degree of burn	Percentage of body surface involved			
	0–25	26–50	51–75	76–100
First	4			
Second	65	11		1
Second and third	1			*5
Third	2			
Total	72	11		6

*Fatal.

TABLE 3.—*Classification of burns according to the portion of the body affected*

Involved area	Number of cases	Percentage of total cases
Face, arms, hands with other parts of body	85	95.0
(a) Face, arms, hands	63	70.0
(b) Other parts of body	22	25.0
Chest, back, legs, only	4	5.0
Total	89	100.0

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TREATMENT

General.—All patients in shock were given morphine and blood plasma immediately. Seven in severe shock, with injuries involving the extremities and abdomen, were given whole-blood transfusions within 10 hours. All patients were given 2 gm. of sulfadiazine immediately, followed by 0.5 gm. every 4 to 6 hours, as a preventive of infection. Those having temperatures over 100° F. were given therapeutic doses.

Burns.—The primary consideration in the treatment of burns was the relief of shock and the replacement of lost body fluids by plasma infusion. Treatment of the burn area followed as soon as the preceding measures had begun. In general every effort was made to cover all burn areas with a vaseline gauze dressing as soon as possible.

Estimation of the body surface involved was used as a general guide in plasma dosage, but in almost all patients in a critical condition it was not possible to give the recommended amount, due to lack of suitable veins because of frequent involvement of the extremities. Under the circumstances, hematocrit readings were neither necessary nor practical as a routine. In the fatal burn cases it is believed that too little, rather than too much plasma was given. The largest amount received by any patient in 24 hours was about 3,000 cc.; all burn casualties retained in the sickbay as bed patients received 500 cc. as an initial dose.

Physical examination and study of temperature, pulse rate, blood pressure and respirations determined future plasma requirements after enough had been given to overcome the initial shock and dehydration during the first 24 hours. It was found advisable in critically and seriously injured patients to infuse plasma through multiple routes simultaneously when possible, thus compensating for the slow infusion rate of single units due to collapsed veins or accidental stoppage, and also providing a certain entrance for emergency parenteral medications. Morphine was used as necessary to relieve pain and shock.

Local definitive treatment consisted of vaseline gauze dressings. Many patients were received in the sickbay with a first-aid dressing of vaseline or boric acid ointment covered by a gauze dressing. In some cases pressure dressings of cellulose cotton under a gauze bandage were used. Unfortunately there was no supply of elastic bandages on board to secure pressure over gauze dressings by this method. In many cases a stockinet was found effective in retaining vaseline gauze dressings in place.

Shell fragment wounds.—These were treated according to their severity. The patients with the largest wounds were operated upon, using intravenous pentothal anesthesia. Wounds were thoroughly

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debrided and scrubbed with soap and water. Sulfanilamide powder was then applied and vaseline gauze packed loosely into the wound, followed by encasement in plaster. In the less severe wounds sulfanilamide powder with a vaseline gauze dressing was applied. No wounds were sutured except facial wounds; these were cleansed and closed with interrupted nylon sutures.

Fractures.—Fractures were compounded in every case but one. All fractured extremities were placed in a traction splint under from 5 to 10 pounds' traction, with elastic cord and triangular bandage foot tie, as soon as they were brought to the sickbay. An ankle tie was used in which the pull was distributed evenly over the largest possible area, with no bulging masses of bandage material or wrinkles, in order to prevent pressure necrosis.

After shock had been overcome and as soon as facilities permitted, the patients were removed to the operating room for definitive treatment. The wound was treated in a manner similar to that used for large shell fragment wounds, followed by a reduction of the bones by manipulation. In most cases previous extension had prevented overriding and no additional traction was necessary. When general anesthesia was indicated, pentothal sodium was given intravenously. Following reduction, the limb was placed in a light plaster cast. Most limbs were encased within 48 hours, but some were maintained in the splint traction device for 72 hours without ill effect, while awaiting definitive treatment.

Amputations.—In cases in which the extremities were badly mangled, with impaired circulation, whole blood transfusions were given prior to transfer of the patient to the operating room, and a guillotine amputation was performed, using intravenous pentothal anesthesia. The stump was treated with sulfanilamide crystals and a vaseline gauze dressing was applied. Adhesive skin traction was applied to the stump, employing a traction splint similar to that used for immobilizing fractures.

Miscellaneous wounds.—The two cases of blast concussion were characterized in one patient by chest pain without physical findings, and in the other by abdominal pain and rigidity. The latter patient was given therapeutic doses of sulfadiazine, partly as a therapeutic trial and partly in preparation for laparotomy. No operation proved necessary, however, recovery of both patients being complete in 24 hours.

One patient had a penetrating shell fragment wound of the right upper quadrant of the abdomen. On surgical exploration a moderate laceration of the liver was found, and fracture of the eighth and ninth ribs noted. About 5 hours later he developed marked dyspnea which gradually increased in severity. A thoracentesis was performed and about 6 ounces of sanguineous fluid removed from the left side of the

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chest, but without relief of dyspnea. Plasma and oxygen therapy were without significant effect and death occurred 10 hours later. An autopsy was not performed.

COMMENT

Of those patients brought to the sickbay, nine died within 72 hours. Seven of the nine had second- and third-degree burns covering over 75 percent of the body. One of these patients suddenly developed a temperature of 108° F. and died within a few hours. Dehydration was suspected, but 5,000 cc. of intravenous fluids failed to produce secretion of urine or sweat. The patient had received the same plasma therapy as the other seriously ill patients.

Four days after the attack 103 patients were transferred to a hospital ship. Of these, 4 were considered to be in critical condition, 24 seriously injured, and 75 had favorable prognoses. Twenty-nine patients with favorable prognoses were retained on board. There were no clinically recognized cases of infection in spite of the severe damage to tissue, with opportunity for the entry of infectious organisms, that occurred in many of the more seriously injured. Within 4 weeks 39 patients had been returned from the hospital ship as fit for duty.

Some details of organization and of solution of special problems follow. Plasma teams were organized, consisting of groups of hospital corpsmen working under the direction of medical officers. In routine cases the entire procedure of plasma infusion was handled by the team members. In many cases when difficulty was encountered in entering veins due to location of burns in the antecubital spaces and the collapse of veins due to shock, the medical officers started the infusion. There were many cases in which it was almost impossible to find suitable veins. This difficulty was partly surmounted in various ways. In three cases cannulization was used very satisfactorily. It is obvious that this procedure could not be delegated to the corpsmen. Intrasternal puncture with improvised equipment was employed in one case, but was found too slow. The corpus cavernosum of the penis was used successfully in one case. In another case, a dilatation of the dorsal vein of the penis obtained by the use of a tourniquet at the base of the penis was sufficient to provide access through this route. This site was found very satisfactory in other difficult cases.

Other sites such as the femoral vein were tried with different degrees of success. Probably the most used was a vein of the foot. It was found that plasma therapy in seriously injured patients required constant supervision, and that the mere mechanical connection of the apparatus to the patient did not guarantee the actual entrance of the fluid in the body. Approximately five patients suffered relatively mild

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reactions, consisting of a chill, following plasma use. The response of patients to plasma was most favorable, and there was no serious reaction. Objective evidence of the value of plasma therapy was apparent in the prompt relief of shock in many cases, followed by gradual clinical improvement in most.

Bandage teams were organized among the hospital corpsmen, which enabled the medical officers to give more attention to those seriously wounded. The efficiency with which they performed this duty was admirable.

Intravenous pentothal sodium anesthesia was used almost entirely in operative procedures, and was given by the junior dental officer.

Some data on supplies used may be of interest. The following items were used in the amounts indicated during the 4-day period in which 141 casualties were cared for: Blood plasma, 250 units (250 cc. @); plaster of paris, 225 prepared bandages; 5-percent dextrose in saline, 26 liters; physiologic saline solution, 23 liters; morphine Syrettes, 215 individual units.

CONCLUSIONS

1. Therapeutic measures thought most effective were (1) administration of prompt and efficient first aid by members of the crew at the scene of the catastrophe; (2) administration of blood plasma and morphine; (3) prophylactic use of sulfonamide drugs, orally and locally, to prevent infection; (4) traumatic surgery according to accepted principles; and (5) careful nursing care by members of the hospital corps and crew volunteer assistants.

2. It is believed that the difficulty in infusing sufficient amounts of blood plasma in serious burn cases should have been met by a substitution of serum albumin, which is known to be more effective in the treatment of shock, per unit volume, because of the very small molecular structure of albumin which gives it a colloid osmotic pressure many times greater than that of globulin.

3. The routine use of pressure dressings is impractical in the treatment of a large number of serious burn casualties occurring in a short space of time with limited facilities. Great difficulty was encountered in keeping dressings in place in most instances. It is thought that a paraffin wax, open air technic as advocated by Pendleton [1] may provide a solution to this problem. This method of treatment also makes possible the safe use of inexperienced personnel in treating patients, a desirable factor when there are overwhelming numbers of wounded, or when there is loss of hospital corps personnel. All battle dressing stations on this carrier have since been equipped with a fly sprayer and

[1] PENDLETON, R. C.: Paraffin wax open air treatment of burns. J. A. M. A. 122: 414-417, June 12, 1943.

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a capped bottle of paraffin wax mixture which is warmed in the sterilizer whenever general quarters is sounded.

4. Although no infections with gas gangrene or tetanus bacilli occurred, prophylactic doses of antitoxin probably should have been given within the 4-day period in which patients were treated aboard ship.

5. A supply of clean sheets obtained from wardroom stores should be placed in each battle dressing station for covering patients suffering from burns of large extent. The necessity of a large dressing which could be used to cover the patient's body quickly prior to evacuation from the immediate scene of the casualty was brought out at the time of this emergency. Gauze rolls, 12 inches wide and 25 yards long, prepared by immersing in heated vaseline slightly thickened for tropical climatic conditions by the addition of a small proportion of beeswax, should also be added to the supplies of each battle dressing station.

6. Although caps and masks were worn whenever practical by medical personnel in the debridement and treatment of wounds and burns, there were many instances when these injuries were treated by members of the crew, hospital corpsmen, and even medical officers by an unsterile technic because of the circumstances. It is interesting to note the absence of recognized infections in cases which were unavoidably contaminated. It is suggested that the low incidence of upper respiratory infections in the crew at the time may have contributed to the generally favorable outcome.

ANTITOXIN IN GAS GANGRENE

The prophylactic use of either serums or drugs, or both together may serve a valuable purpose in making both early and delayed surgery more secure, or in permitting primary closure of a wound which would otherwise be left open, and many surgeons now prefer to use both these adjuncts. But the use of serums or drugs can never be regarded as a substitute for adequate surgery.

The treatment of infected wounds under catastrophic conditions, as in war, earthquakes and train accidents, must necessarily be based upon the assumption that prompt surgery is generally impossible. Under these conditions the injection of polyvalent, preferably pentavalent, gas gangrene antitoxin and tetanus antitoxin assumes a major prophylactic role, making possible and effective delayed surgery to save lives and limbs. It is necessary, of course, to guard against anaphylactic shock in asthmatics and others sensitive to horse serum.—HALL, I. C.: Value of antitoxin in prevention and treatment of malignant edema and gas gangrene; review of observations. Ann. Surg. 122: 197–209, August 1945.

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RADIATION SICKNESS IN NAGASAKI

PRELIMINARY REPORT

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When the U. S. S. *Wichita* steamed into Nagasaki Ko on 11 September 1945 an opportunity to make a relatively early study of the radiation effects resulting from the explosion of the atomic bomb was offered. This study was begun approximately 33 days after the initial blast and about 10 days prior to the arrival of the various atomic bomb commissions scientifically studying and surveying the effect of mankind's newest war weapon.

During the first days of the investigation an average of 20 new cases were admitted to the hospital, but within 2 weeks the admitting rate sharply dropped to 1 or 2 new cases daily.

Our investigation was conducted at the Chinkozen Primary School which the Japanese were using as a hospital because the hospital and medical school of Kyushu University at Nagasaki were destroyed. The Japanese medical staff working at this improvised hospital consisted of local doctors and several staff physicians from the University Hospital at Fukuoka. The Japanese medical authorities showed no signs of animosity and were at all times courteous and cooperative. Some difficulty was experienced, not only in the obtaining of case histories, which had to be done through nonmedical interpreters, but all laboratory tests had to be repeated when it was discovered that the Japanese standards differed from our own.

This study was abruptly terminated on 25 September 1945, when the U. S. S. *Wichita* departed for Sasebo; however follow-up reports have since been obtained. Case records have been sent to Col. S. L. Warren, M. C., A. U. S., in charge of the scientific group, Manhattan Division, Corps of Engineers, carrying out extensive studies on radiation effects of the atomic bomb, both at Nagasaki and Hiroshima; and Commander Shields Warren (MC) U. S. N. R., who is carrying out a similar investigation with a U. S. Naval technical unit.

When the atomic bomb exploded, the concentrated energy diffused itself in three main channels; namely, pressure, heat, and radiation. The effects of the atomic bomb differ from the ordinary explosive bomb only in its release of radiant energy. The atomic splitting bomb dropped on Nagasaki was exploded at an estimated altitude of

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800 feet. At this height much of the radiant energy was expended into the atmosphere with the probably anticipated result that the underlying terrain would not remain radioactive for a prolonged period. In contrast, the New Mexico test bomb, exploding only 100 feet above the ground, caused the earth in the surrounding area to contain radioactive materials for months after the explosion. The effects produced by the atomic bomb on human beings, due to excessive pressure and heat, differ in no way from those of the ordinary bomb. However the release of radiant energy is something new in modern warfare and consequently opens a new field in military medicine.

Our first concern was the amount of radiant energy possibly remaining in the area and in the victims. X-ray film buried in the bombed area and attached to various objects about the so-called crater (a true crater does not exist) failed to reveal the presence of radioactive elements. Later the other investigators, with the aid of Geiger point counters, reported the area to be safe and found only negligible amounts of radiation. X-ray films were then attached to the limbs of atomic victims at the hospital and kept in place for 18 hours. All of these films failed to reveal radiation, which may be explained by the fact that although these patients were exposed to forms of radiant energy they did not absorb any in large amounts.

The patients examined revealed true forms of radiation sickness which were similar to the acquired or experimentally produced cases seen in the United States. The Japanese claimed that during the first week most of the deaths were the result of radiation sickness; however they did not differentiate blast victims from radiation patients. They also attributed to radiation many thermal burns. It can be assumed, however, that a large percentage of the early victims died of radiation effect. The striking force consisted of two aircraft, and when the bomb was dropped most of the civilians were not in air-raid shelters. This is explained by the fact that the Japanese were not accustomed to sound "air alert" for a supposed "small" raid. The air-raid shelters probably would have afforded adequate protection had they been constructed of concrete about 2 feet in thickness.

All of the victims seen came from the same local area. No patient was found who had been beyond 3 kilometers from the center of the explosion area.

Only a few cases which could be classified as x-ray skin burns were noted. Differentiation from a thermal burn is difficult, particularly with a number of flash burns present, but when the burns appeared 4 or 5 days after the explosion and without apparent cause, it was assumed that they were of radiation effect. The few x-ray burns observed were mild in character.

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1. Alopecia in a girl exposed to the radiation of the atomic bomb.

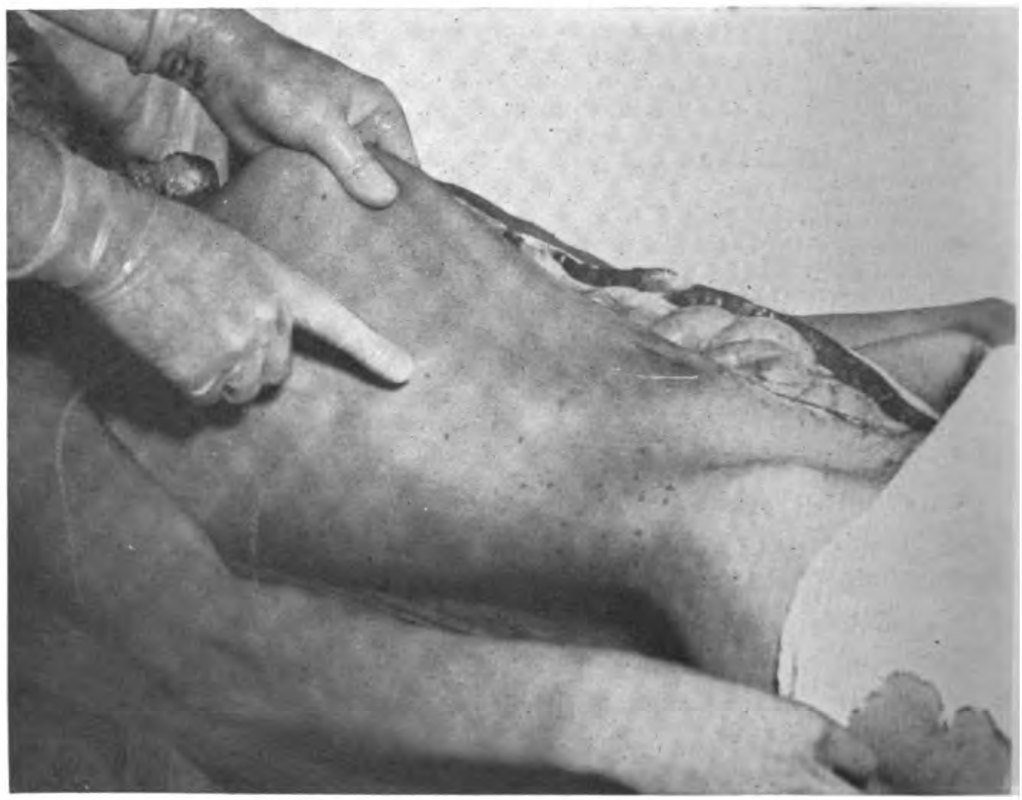
Many cases of alopecia were seen. Some of these victims began to lose their hair 4 or 5 days after the explosion, while others first noted this phenomenon about the third week. None of the cases exhibited complete loss of hair. At the end of a month a few of the patients had already begun to grow new hair of a downy nature. The permanency of the alopecia at this time is purely speculative.

The principal effect of the radiation was on the bone marrow, with a marked degree of depression of the marrow function. Most of the cases seen showed an aplastic type of anemia. The blood was deficient in red blood cells and hemoglobin, but was not markedly hypochromic. As granulopoiesis was greatly impaired, agranulocytosis resulted. A lymphocytosis existed, but seemed to be of a relative nature. A

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2. Alopecia seen in atomic bomb victims.



3. Demonstration of petechiae seen in radiation sickness caused by the atomic bomb.

number of white blood cell counts under 1,000 were seen and in some of the cases the white blood cells completely disappeared before death.

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4. A case of noma in an atomic bomb victim.

A white blood cell count under 1,000 offered a poor prognosis; however one patient with 400 cells per cu. mm. recovered. Although platelet counts were not made, smears showed a great decrease in the number of thrombocytes, and in some of the smears they had completely disappeared. Petechiae were commonly seen, as were gross hemorrhages. Bleeding times were increased and often were found to be prolonged over 45 minutes. Jaundice was not seen, but all of the patients showed a marked degree of pallor of the mucous membranes. The liver was found slightly enlarged in only one case, and the spleen was not enlarged in any case. Urinalysis frequently revealed albumin, casts, bile, and red blood cells.

The average newly admitted patient complained of fever, malaise, loss of appetite, bleeding gingivae, and hemorrhagic diarrhea. Ex-

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amination revealed generalized petechiae, alopecia, various buccal lesions, and the blood picture of aplastic anemia.

The oral changes consisted of a glossy, smooth tongue, with ulcerative lesions of the mucous membranes. The ulcers were composed of necrotic areas with a complete clinical absence of a surrounding inflammatory zone. The lesions bled easily, were often grossly infected and showed no tendency to heal. Two cases of necrosis of the mandible were seen and one case of noma with ulceration of the lips and necrosis of the mandible and maxilla. The teeth were generally loose and easily removed by hand. Lieutenant Earl V. Harrington (DC) U. S. N. found that the teeth were loosened in the following progressive order: Upper anterior, upper posterior, followed by the lowers. He also found the gingiva was slightly hypertrophied and the looseness of the teeth was due to destruction of the alveolar bone and periodontal membrane. A few of the cases showed excessive salivation. Commander Warren has stated that some of the gold removed from the teeth of these victims contained radiant energy.

Many of these patients died as a result of terminal infection, particularly bronchopneumonia. The result of autopsies and bone marrow smears will be reported in detail in forthcoming articles by Commander Shields Warren and Col. S. L. Warren.

Prognosis was difficult as it often depended on the presence or absence of an intercurrent infection. In general it appeared that the younger individuals had more recuperative abilities, and a progressive rise in the white blood cell count, particularly in the number of granulocytes, was a good omen.

Opportunities for therapeutic endeavors were necessarily handicapped by our limited supplies. Japanese attempts at treatment were meager, since most of their medical stores had been depleted. Their therapy consisted of small amounts of vitamins, liver extract, and an occasional blood transfusion. Of our own supplies, penicillin and plasma had the anticipated beneficial effects. The one case of noma responded particularly well, in that the patient was converted from a critical status and was placed on the road to recovery within 2 days. Liver extract seemed to benefit a few patients, but in general was not very effective. Pentnucleotide was used in limited amounts, namely, 3 cc. three times daily, in seven cases, and in each one of the patients a progressive rise of the white blood cell count appeared in 24 hours. Only one patient on whom pentnucleotide was used had a white blood cell count under 1,000, and the remainder were under 2,000. Some of the patients who acquired infections would respond with a leukocytosis. The use of calcium to replace calcium fixed with radioactive salts was not attempted as it was felt that the body organs possessed only minor amounts of radioactivity.

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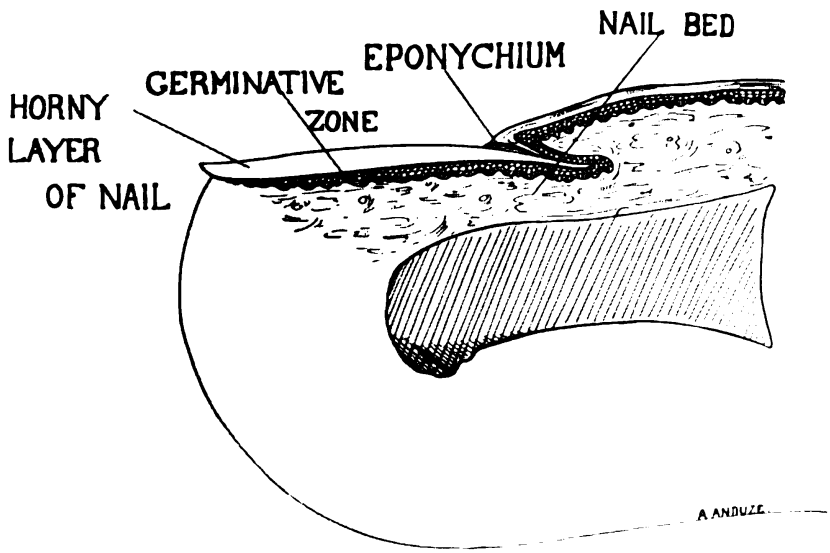
SUTURE OF THE FINGERNAIL IN CRUSHING INJURIES

WENDELL H. HAMRICK
Lieutenant Commander (MC) U. S. N. R.

In certain injuries of the fingertip when the nail root has been avulsed, but the distal part of the nail remains partially attached to its bed, the remaining portion of nail may be utilized as a protective covering by suturing directly through the nail. This method is almost uniformly successful in obtaining early healing, shortened disability, and minimum residual deformity. The denuded distal phalangeal bone is covered by remaining nail matrix or bed, and the necessity for either amputation, or a long waiting period until granulations form, is avoided.

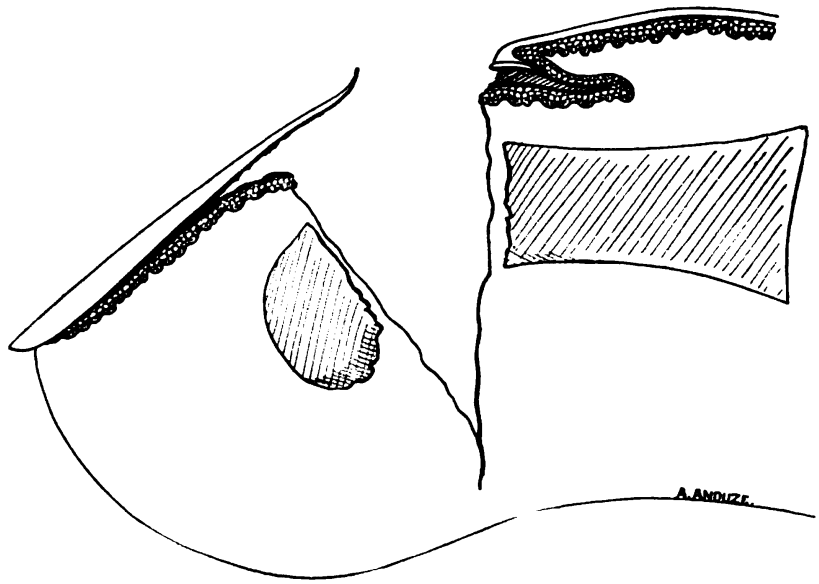
Figure 1 represents the normal fingertip, while figure 2 shows a typical injury best treated by this method. The trauma is usually caused by the sharp edge of a slammed window, car door, or frequently by a cutting tool in industry.

Occasionally the nail may be transversely sectioned, together with soft tissues and bone, but more often the root is avulsed, lying exposed on the dorsum of the finger, while the distal half of the nail remains partially attached to its bed. A palmar bridge of varying thickness



1. The normal fingertip.

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2. Typical injury, showing nail root avulsed, distal three-fourths of nail partially attached, phalanx fractured. The distal bone fragment is often crushed.

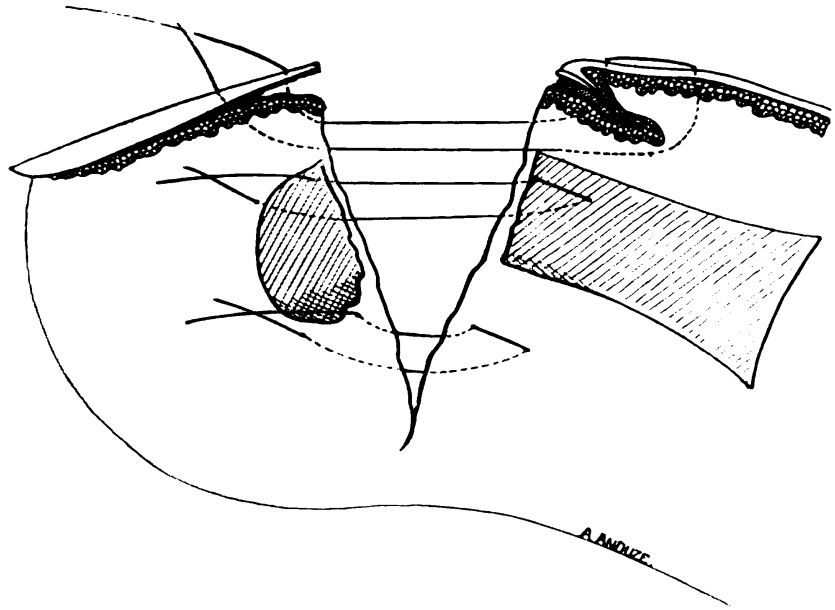
is often all that remains of what was almost a complete amputation, and this is probably explained by the fact that the palmar surface is usually resting on a flat surface which acts as an anvil for the sharper striking force applied dorsally.

Bleeding from three or four minute arteries on either side of the proximal wound edge gives evidence of the rich blood supply to this part, and bleeding of the distal edge may or may not be noted as evidence of good remaining blood supply through the bridge of tissue. No opportunity of suturing the completely amputated tip has been offered, but other crushing injuries have been treated by variations of this method with good results.

The typical injury is treated as follows: Block anesthesia is secured at the base by the bilateral injection of 2-percent procaine without epinephrine, an additional cubic centimeter being fanned out subcutaneously on either side. A tourniquet is not used. Local infiltration so distorts the fingertip that the reported risk of nerve block at the base is chanced.

The finger is then cleansed thoroughly with ether, green soap, and sterile saline solution. Sterile draping is done, and aseptic technic is used throughout the remaining procedure. Thorough scrubbing of the wound surfaces, including the nail edges and bone, is done. Hemostasis is effected temporarily by small hemostats after initial debridement. The nail root is transected with scissors, and the proximal edge of the remaining distal attached nail is trimmed to fit the curvature of the eponychium. The distal fragment of bone is found firmly

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3. Lateral view showing placing of mattress sutures after thorough debridement and excision of avulsed nail root.

attached to the fibrous cords of the tip pulp. In most cases it is removed by sharp dissection, but if the palmar skin bridge is so small as to make blood supply questionable, the chips are left in, thus avoiding dissection that might further jeopardize blood supply. Union rarely occurs, but this appears to offer no inconvenience.

Soft tissue wound edges are then trimmed, the small globules of fat that protrude through the wound edges being excised with scissors. The epidermis of the distal wound edge is trimmed carefully so that none of it overhangs, as this portion is not usually viable.

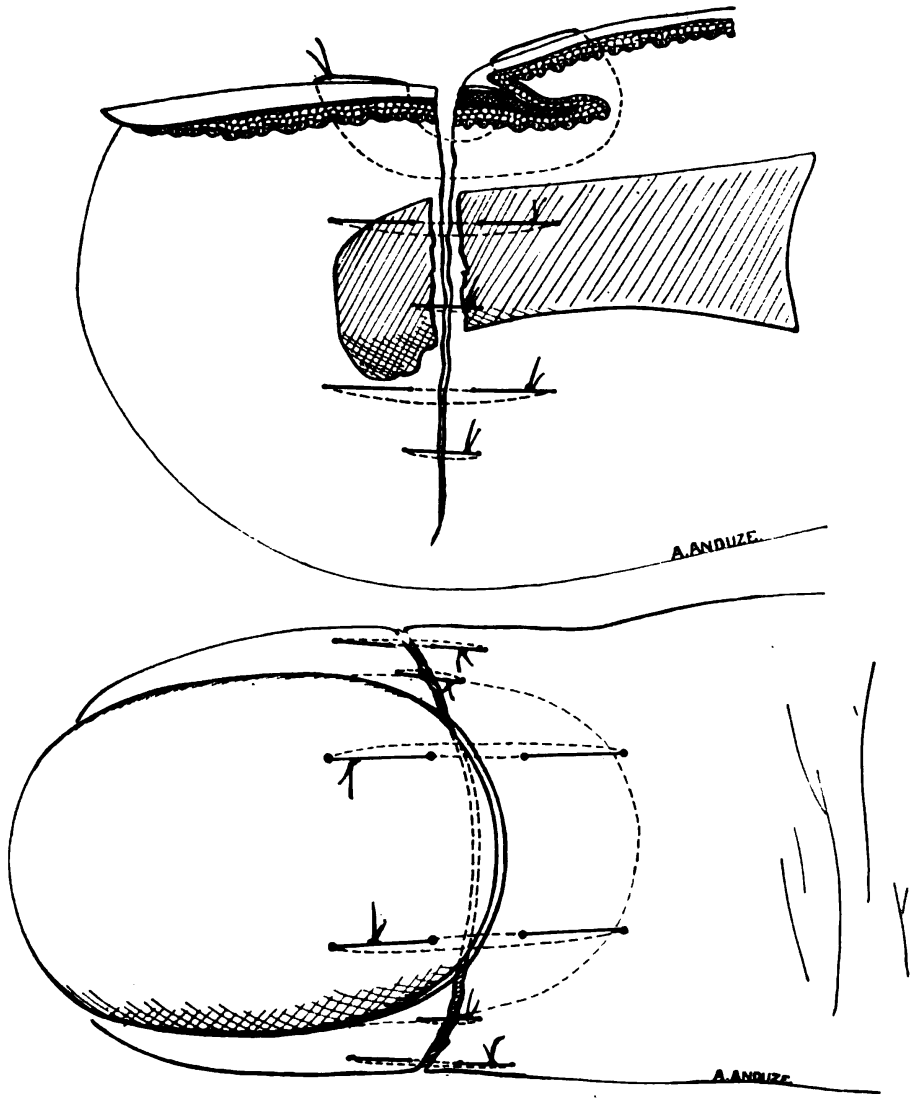
Accurate apposition of soft tissue surfaces is very important for rapid healing. After such trimming and debridement, the nail may require further shortening due to diminution in size of the tip. Any part of the nail matrix or bed that remains attached is carefully preserved, even if frayed.

Using any nonabsorbable suture of about 000 dermal size on a small curved cutting needle, two vertical mattress sutures are placed through the nail and proximal wound edge as illustrated in figures 3 and 4. The nail is easily pierced by the cutting needle if the tip is held firmly. Similar deep mattress sutures are placed in the soft tissue wound of either side in sufficient number to obtain perfect apposition, and deeply enough to close all dead space. No sutures are tied until all are placed. Hemostats are removed progressively as the sutures are tied, without ligation of vessels.

Sulfanilamide crystals may be lightly dusted into the wound just before tying the sutures, but the value of this procedure is question-

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4 and 5. Lateral and dorsal views after tying of sutures. Wound edges are gently apposed with minimum tension.

able, as the crystals have a tendency to provoke serum collection. A dry dressing is applied, a sterile strip of cellophane (cigarette package cover) first being laid over the wound edge to prevent sticking. Vaseline gauze is never used. An aluminum or tongue-blade splint is then applied, and the patient is allowed to continue usual activities within limits. Redressings are infrequent, and the sutures are not removed until the tenth to fourteenth day. At this time the remaining nail will begin to loosen from its bed, and may be completely detached by the twenty-eighth day. The nail root is often visible by the fourteenth day as a firm crescent just beginning to harden beneath the eponychium. It often grows out completely in a few months, with little deformity, and is firmly attached at the root and most of the peripheral nail bed.

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COCCIDIOIDOMYCOSIS AT U. S. M. C. AIR STATION, MOHAVE, CALIFORNIA

EUGENE F. PFANNER
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Coccidioidomycosis, also known as "San Joaquin Valley fever," "desert fever," or "desert rheumatism," in its primary or acute form is prevalent in recognized endemic areas of the United States. These known endemic areas include the San Joaquin Valley in California; scattered regions in counties south of the Tehachapi Mountains, California; regions around Phoenix and Tucson, Arizona; and central western Texas around San Angelo. Other known North American areas include New Mexico and Mexico. There is also the known endemic region of Chaco in Argentina.

Coccidioides granuloma, or the progressive, disseminated type of infection, was first recognized in 1892 by Posada in Argentina. Rixford and Gilchrist recognized the causative agent as being the fungus Coccidioides immitis in 1896. The acute primary type of infection was first reported by Dickson and Gifford [1] in 1938. They proved the causative agent to be Coccidioides immitis and suggested the name "coccidioidomycosis." Coccidioidomycosis was to include the progressive, disseminated infection as well as the benign, initial coccidioidal infection.

The background and historical record of coccidioidomycosis, as well as a description of the clinical picture, etiology, morphology of the phycomycete, pathogenesis, distribution, diagnostic measures, and treatment have been very adequately and clearly presented in numerous articles. These articles contain bibliographies which will enable one to find all of the known information about this clinical entity. The parallelism of coccidioidal and tuberculous infections has also been clearly presented.

The impetus to conduct a survey of this disease came from several sources. The senior medical officer at this station developed all the symptoms and signs of coccidioidomycosis. Later, coccidioidin and considerable information and literature were obtained from Dr. C. E. Smith, Professor of Public Health, Stanford University School of Medicine and consultant on epidemic diseases to the Secretary of War. Dr. Smith suggested that a survey be conducted at this station along

[1] DICKSON, E. C., and GIFFORD, M. A.: Coccidioides infection (coccidioidomycosis); primary type of infection. Arch. Int. Med. 62: 853-871, November 1938.

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the lines recommended by the Commission on Epidemiological Survey, the purpose being to determine whether the U. S. Marine Corps Air Station at Mohave and the vicinity was an endemic area for coccidioidomycosis.

The personnel were skin-tested as soon after arrival as possible. Those men whose tests were negative were again tested at a later date and the results noted. Those whose tests were originally negative, and positive on the second test, were considered as having contracted the infection. This has been called the "changeover" in reaction and has been taken as a criterion of infection.

MATERIAL AND METHODS USED

The coccidioidin used was obtained from the Commission on Epidemiological Survey through Stanford University School of Medicine. Undiluted, it was kept refrigerated and each month a fresh 1:100 solution was made. Tuberculin syringes and needles used to make the tests were new and had not been used for any other biologic tests. One-tenth of a cubic centimeter of the 1:100 dilution was injected intracutaneously into the medial surface of the forearm, and the tests were read at the end of 48 hours. All tests were given and read by the same person. No controls were used. A 1+ reading was considered a positive test.

The following criteria were used in reading and recording the tests.

COCCIDIOIDIN TEST

± Definite induration and erythema, but less than 1 cm. in diameter.
\+ Induration of 1 cm. or more in diameter.
\+ + Induration of 1 cm. or more in diameter, plus a flare of erythema of 1 cm. or more surrounding the induration.
\+ + + Induration of 2 cm. or more in diameter.
\+ + + + Induration plus vesiculation.

The tests were carried out over a 10-month period, April 1943 through January 1944, and during that time 1,969 coccidioidin skin tests were made upon the personnel of the station. One hundred twenty-five tests were not read because of failure of the personnel to return at the proper time; these tests were discarded, leaving a total of 1,844 skin tests as a basis for this report. Four hundred seventy-two tests were repeated, at average interval of 4.6 months. A total of 1,372 persons were tested, and no generalized reaction and no infection was observed as a result of the tests. Localized reactions, such as blebs or vesicles were noted, one vesicle measuring 2.5 by 3 centimeters. There was also noted with this large vesicle an erythematous reaction covering practically the entire medial surface of the forearm.

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A total of 1,728 negative coccidioidin skin tests were recorded; 434 of the repeated tests were negative. There were 116 persons with positive coccidioidin skin tests; 30 of these were recorded as "changeovers."

Analysis of those with positive reactions revealed that 24 men had lived in the San Joaquin Valley, 21 in Texas, 8 in Arizona, 1 on the California-Mexico border, and 1 in New Mexico. These areas are endemic for coccidioidomycosis. Twelve of the men whose skin tests were positive came from Arkansas, Missouri, Michigan, Ohio, Tennessee, Kentucky, Alabama, Pennsylvania, and Iowa. Eight of these twelve with positive tests were 1+. This is the area, with the exception of Iowa, which has been found "to pose a very vexatious problem in coccidioidin interpretation. There seems to be a strong possibility that some other infection in that region causes these equivocal reactions."

There were six positive skin tests in men who had not lived in other endemic areas and who had probably contracted the infection at this station. This latter group did not have repeated tests and therefore cannot be counted in the group that contracted the infection in this area. Four of the eleven men hospitalized had positive tests, but they were not tested prior to contraction of the infection. Eight men had positive results on both the first and second skin tests.

Twenty-three men had negative coccidioidin skin tests which became positive when the test was repeated at an average of 4.6 months later. These were "changeovers."

Negative coccidioidin skin tests which became positive when repeated at an average of 4.6 months later

	Came to station	Date of 1st test	Date of 2d test	Result of 2d test	Home of individual
1	6-25-43	7-11-43	12-15-43	2+	Illinois.
2	8-24-43	8-25-43	12-15-43	1+	Washington.
3	6-25-43	7-11-43	12-15-43	2+	Louisiana.
4	3- 5-43	7- 8-43	12-15-43	1+	Ohio.
5	7-11-43	7-12-43	12-14-43	2+	Southern California.
6	6-25-43	7-12-43	12-15-43	1+	Maryland.
7	4- 7-43	4-21-43	9-23-43	2+	Kansas.
8	8-26-43	8-30-43	12- 3-43	1+	Alabama.
9	8-26-43	8-30-43	12- 2-43	1+	Massachusetts.
10	9- 8-43	9- 9-43	12- 2-43	1+	Colorado.
11	7-11-43	7-12-43	12- 2-43	1+	Michigan.
12	10-22-42	4-21-43	7-21-43	1+	Missouri.
13	4- 6-43	4-21-43	8-19-43	1+	Pennsylvania.
14	6-15-43	6-28-43	10-22-43	2+	Tennessee.
15	9- 8-43	9- 9-43	10-22-43	1+	Pennsylvania.
16	8-26-43	8-30-43	10-22-43	2+	Wisconsin.
17	2- 1-43	4-21-43	12-15-43	2+	Ohio.
18	4- 6-43	4-21-43	7- 1-43	4+	Nebraska.
19	3-11-43	4-21-43	7- 6-43	1+	Missouri.
20	3-11-43	4-21-43	7- 6-43	2+	Oregon.
21	6-23-43	7- 1-43	12-15-43	1+	Oklahoma.
22	5-15-43	7-19-43	12-15-43	1+	Maryland.
23	8-24-43	8-25-43	12-15-43	1+	Ohio.

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Careful inquiry was made to determine if any of these Marines had been to any of the other known endemic areas during the interval between the negative and the positive coccidioidin skin tests.

Seven men were hospitalized with the disease. These patients had negative coccidioidin skin tests which later became positive during the course of the disease.

CASE REPORTS

Case 1.—On 7 July 1943 this Marine complained of a cold with tightness and pain in his chest, and associated slight headache, anorexia, backache, and aching in his joints. He was admitted to the dispensary on 11 July at which time his temperature was 99.8° F. and his pulse rate 80 beats per minute. Examination of his throat revealed a slight redness over the tonsillar area but there was no exudate present. Examination of the chest did not disclose any abnormality. There was no redness or swelling of the joints, but the joints were painful.

The white blood cell count was 7,300, with an eosinophilia of 3 percent. The erythrocyte sedimentation rate was 33 mm. in 1 hour (Cutler method, 50-mm. tube). X-ray examination of his chest showed an area of consolidation, 3.5 cm. in diameter, in the left lung field. A diagnosis of pneumonia, etiology undetermined, was made. A coccidioidin test made 12 July and read on 14 July was negative.

From 12 July through 22 July the patient's temperature was elevated 2° or 3°, and he continued to have pain in his chest with a slightly productive cough, frequently in paroxysms. The generalized aching and joint pains also continued. There was no evidence of a skin rash. A chest roentgenogram on 22 July revealed an increase in the amount of consolidation. The spread of the consolidation was upward from the mid-lung field. At this time the erythrocyte sedimentation rate was 30 mm. in 1 hour, and the coccidioidin skin test was again negative.

Five days later the sputum examination revealed no pneumococci and the sedimentation rate was 25 mm. in 1 hour. On 13 August another chest roentgenogram was taken. There was improvement in the upper left lung field. Tuberculin tests carried out on this day were negative in the first and second dilution, purified protein derivative. Eight days later there was still a low-grade fever, but there was no rash. The symptoms, generalized aching, joint pains, anorexia, cough, and night sweats had improved.

On 25 August a third coccidioidin skin test was performed and found on 27 August to be strongly positive. A diagnosis of coccidioidomycosis was made. On 30 August a fourth roentgenogram of the patient's chest revealed an improvement. The area of consolidation in the left mid-lung field was now a fuzzy density and had receded in size. The erythrocyte sedimentation rate on this day was 7 mm. in 1 hour. The patient was discharged on 9 September.

This patient had not been outside of this endemic area for 3 months prior to his admission to the dispensary.

Case 2.—The onset of illness in this case was 6 July 1943. The patient had a cold and a cough, followed by a severe pain in the left side of the chest on deep breathing. Between 6 July and 19 July he noticed that he tired easily; he complained of headaches, had one severe night sweat, his elbows, wrists, and knees ached, and he had lost his appetite. He continued to carry on his duties on the station but found that it was an extreme effort. On 19 July red spots appeared upon his legs. He also noticed a patchy red rash on both arms and on the chest. The rash on the arms and upper part of the chest anteriorly had disappeared by

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23 July, but the cough, malaise, joint pains, and lesions on the legs continued until the day of admission to the dispensary.

He continued to be so tired that he reported to the dispensary on 27 July and was admitted. The positive physical findings were a temperature of 101° F. and pulse rate of 100 beats per minute. The skin on the anterior tibial surfaces of each leg showed from 8 to 10 bright red, circular, nodular lesions about one-half to 1 cm. in diameter. These lesions were not painful on pressure. There was also a brown stain on the lateral surfaces of the arms and the upper anterior part of the chest. The conjunctivae were not injected. Percussion and auscultation of the chest did not reveal changes in the lung or heart. The joints were neither red nor swollen but were slightly painful to pressure. The white blood cell count was 6,900 with a 3-percent eosinophilia; the erythrocyte sedimentation rate was 29 mm. in 1 hour (Cutler method). A chest roentgenogram showed an increased density in both hilar regions, the density descending into the bases of both lungs, with several small calcified nodes in the right hilus. The left lung showed strands of increased density from the hilus to the apex with a patch in the second left interspace. The coccidioidin skin test, read on 29 July, was 3+.

On 9 August the patient still complained of backache, anorexia, weakness, and joint pains. His temperature was elevated 2° above normal, and the rash, which resembled erythema nodosum, had disappeared except for a brownish pigmentation. The erythrocyte sedimentation rate was 18 mm. in 1 hour. By 22 August all symptoms had disappeared and the sedimentation rate was 7 mm. in 1 hour. He was discharged to duty.

A coccidioidin skin test made on 28 June had been negative. The patient had not been in any other endemic area for 1 month prior to the illness.

Case 3.—The onset of illness in this case was 20 September 1943. Three days later the patient came to the sickbay complaining of severe pain in his chest. A chest roentgenogram showed the hilar markings to be larger than normal.

On 10 October, 20 days following the onset of symptoms, he was admitted to the dispensary, complaining of chills, fever, sore throat, cough, generalized malaise, and a rash over his body.

The patient's temperature was 101.8° F. and the pulse rate 96 beats per minute. There was an erythema multiforme-like rash over the lower part of the neck, collar-like in distribution, and over the lateral surfaces of the arms and thighs and the anterior tibial surfaces of the legs. Several of the lesions on the thighs were circular and slightly larger and more discrete than the lesions elsewhere. There was no conjunctivitis. Koplik spots were not observed within the mouth, but the throat was red, with small, vesicular, glassy lesions on the tonsillar areas. Physical examination of the chest showed no abnormality.

The laboratory work was limited to a blood count and urinalysis. The leukocyte count was 13,500, with no eosinophilia. An erythrocyte sedimentation rate test, coccidioidin skin test, and x-ray examination of the chest were not done at this time.

By 21 October the rash had spread over the outer surfaces of the back and was more extensive on the arms and legs, and 6 days later the stain of the rash was still present. His temperature had been normal for 1 week and his general condition was excellent. A diagnosis of erythema multiforme was made, and the patient was discharged.

On 2 December a repeat coccidioidin skin test was carried out. The first test, which was negative, had been completed on 24 August. The second test resulted in a reaction of 1.5 cm. of induration, with a surrounding erythema of 2 by 3 cm. The sedimentation rate at this time was found to be 10 mm. in 1 hour (Cutler method). Roentgenograms of the chest showed a circumscribed

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area of increased density, 2 cm. in diameter, in the right first interspace at the periphery of the lung. Comparing the x-ray films of 22 September with the current film, it was found that there was definitely a decrease in the hilar markings as well as in the circumscribed density in the right first interspace. A diagnosis of coccidioidomycosis was made.

This Marine had not been in any other endemic area 1 month prior to the first roentgenographic examination on 22 September.

Case 4.—On 2 October 1943, this patient complained of a cough and a sharp pain in the right side of the chest. During the interval between the onset of symptoms and admission to the dispensary, he experienced symptoms which he called the "flu." The day before admission on 22 October he first noticed red bumps on his legs.

The positive physical findings on admission were a temperature of 101° F., pulse rate of 100 beats per minute, and on the anterior tibial surfaces of the legs there were numerous raised, red, circular lesions which were tender to pressure. The leukocyte count was 8,200, with a 4-percent eosinophilia. The sedimentation rate was 18 mm. in 1 hour (Cutler method). A roentgenogram of the chest made on this day revealed 6 small, irregularly shaped areas of increased density in various locations in the lungs, the largest being 3½ by 1½ cm. It was located in the eighth right interspace and was more or less oval in shape.

A coccidioidin skin test was made on 24 October and found positive 2 days later. The induration was over 1 cm. in diameter, with a surrounding erythema of 3 by 4 cm. A previous test, performed on 25 August, had been negative.

On 26 October the patient complained of backache, pain in the joints, and general weakness. He had had a severe night sweat on 25 October. The temperature was 103° F., but by 28 October both temperature and pulse rate were normal and there was an improvement in the patient's appetite.

By 3 November the lesions on the legs were fading and the sedimentation rate was 12 mm. in 1 hour. Two days later a repeat roentgenogram of the chest showed the same lesions as on the previous film, although these changes were not so pronounced. On 8 November the erythrocyte sedimentation rate was 5 mm. in 1 hour, and the patient was discharged to return for roentgenographic checkup within 1 month. Repeat films taken on 30 November revealed a normal lung field.

Case 5.—The onset of illness in this case was pain in the chest experienced on 19 October 1943. Prior to admission to the dispensary on 23 October, the patient had complained of aching in his joints, general malaise, anorexia, backache, extreme weakness and profuse perspiration. On admission he was complaining of pain in the left side of the chest and respiratory difficulty. His past history disclosed that he had lived in three of the known endemic areas for coccidioidomycosis; namely, Texas, Arizona, and New Mexico. On 24 August a coccidioidin skin test yielded a negative result.

His temperature on admission was 101° F., pulse rate 108 beats per minute, and respirations were 30 per minute. Coarse inspiratory râles were heard over both interscapular spaces. The percussion note was not dull over this area. The joints were tender but not red. The leukocyte count was 10,500, with no eosinophilia present. The erythrocyte sedimentation rate was 22 mm. in 1 hour (Cutler method). X-ray films of the chest showed a hilus and peribronchial thickening on the left side, with extension of the increased density to the periphery of the lung in the first and second interspaces. On 24 October a coccidioidin skin test was done, and read 2+ on 26 October.

On 30 October the patient's temperature was 100° F., pulse rate 88, and respirations were 24 per minute. He was still coughing, with slight production of a thick,

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tenacious, yellow sputum. His joints still bothered him and he had not regained his appetite. By 5 November the cough had improved and he did not experience the weakness that had been so prevalent throughout the illness; the temperature was elevated 1° and the respiratory rate had returned to normal. The erythrocyte sedimentation rate was 14 mm. in 1 hour.

Eight days later the temperature was normal and he had regained his appetite. Roentgenogram of the chest showed a clearing of the increased density in the upper part of the left lung, although the hilar region on the left side was not completely clear. On the day of discharge on 18 November, the erythrocyte sedimentation rate was 7 mm. in 1 hour. A coccidioidin skin test was repeated on 2 December and showed a 2+ reaction.

Case 6.—On 10 October 1943, this patient first complained of a cough and pain in his right side. He was seen in the sickbay and given symptomatic treatment. He returned 2 days later, and x-ray examination of his chest showed a mottling and irregular dense shadow throughout the upper lobe of the right lung with somewhat the same picture at the base of the right lung. A coccidioidin skin test on 30 August was negative.

On admission on 13 October, the patient complained of symptoms of a severe upper respiratory infection, headache, cough, generalized aching, weakness, and backache. Physical examination showed the temperature to be 101° F., the pulse rate 98 and the respirations 24 per minute. The face was flushed. Fine crackles were heard on deep inspiration over the right upper part of the chest posteriorly. The percussion note was resonant. There was no evidence of joint disease. The white blood cell count was 5,500, with 1 percent eosinophils. The sedimentation rate was 26 mm. in 1 hour (Cutler method). On 15 October a coccidioidin skin test was completed and found to be positive, the induration measuring 1.7 cm. in diameter, with a surrounding erythema of 4 by 7 cm.

Ten days later the patient still had a low-grade fever and continued to have paroxysms of coughing several times a day. The weakness and backache persisted. By 15 November his condition was very much improved. He had a good appetite, the aching joints had disappeared, and the cough did not trouble him. The sedimentation rate on this day was 14 mm. in 1 hour. On 1 December he was discharged.

This patient had not been off the station since 26 August 1943.

Case 7.—The patient, a middle-aged white male, first complained of a cough and generalized aching in his joints on 22 October 1943, and believed it to be the "flu." On the following day he had a severe pain in his chest which was aggravated on coughing. Continued loss of appetite, headache, weakness, and joint pains caused him to come to the dispensary where he was admitted on 26 October.

His temperature was 100.6° F., the pulse rate 94 and the respirations were 26 per minute. He appeared to be acutely ill with an upper respiratory infection. No rash was found on his body or extremities. Percussion and auscultation of his chest failed to show any signs of pathologic changes in the lungs. The sedimentation rate was 28 mm. in 1 hour (Cutler method). X-ray examination of the chest showed the right hilus to be consolidated, with a large patch of increased density at the periphery of the right lung from the second to the fifth rib. On the following day the patient's temperature was 104° F., and his cough was paroxysmal, with production of a light yellow, tenacious sputum. There was no blood in the sputum. A coccidioidin skin test was strongly positive. The original coccidioidin skin test taken on 23 September had been negative.

A skin rash developed on 29 October over the lateral surfaces of the arms, characteristic of erythema multiforme. There was also an erythema nodosum-like lesion over the anterior tibial surfaces of both legs. He had been receiving

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sulfathiazole and this rash was considered as being due to the drug. An erythrocyte sedimentation rate test was repeated on 4 November and found to be 30 mm. in 1 hour. At this time the temperature was 101° F. The temperature, pulse rate and respirations returned to normal on 7 November and the patient was relieved of most of his symptoms. The rash on his arms and legs was still present, although the sulfathiazole had been discontinued for 9 days. The joint pains remained, especially in the ankles. On 9 November the cough and chest pain recurred, and a check roentgenogram of the chest showed consolidation in the right lung field, this time with additional shadows in the left lung field. The following week the patient continued to have a low-grade fever. The sedimentation rate, taken on two occasions during this period, was 25 mm. in 1 hour and over. A stain was still visible over the patient's arms, neck, and lateral surfaces of his thighs, and the lesions on his legs were still visible.

During the last 12 days in November the joint symptoms and a cough continued, although there was a noticeable improvement. There was an elevation of 1° or 2° in the temperature on several occasions. December showed definite improvement in his symptoms and signs, although the sedimentation rate still remained over 15 mm. in 1 hour. The paroxysms of coughing had ceased, but the cough was still present. A roentgenogram taken on 30 December revealed a haziness but not complete consolidation over the right lung field, from the second to the fifth ribs. There was also improvement in the region of the right hilus as well as in the invasion of the left lung. The patient was discharged to duty and leave for 2 weeks. On 25 January a roentgenogram of the lungs showed a clearing of the entire process, and the erythrocyte sedimentation rate was found to be 6 mm. in 1 hour.

COMMENT

In the group of men who had two skin tests at an interval of 4.6 months the results were as follows: 434 skin tests were negative on both the first and second tests; 23 Marines had negative skin tests which later became positive "changeovers," and 7 of the hospitalized patients had negative skin tests that were later recorded as positive during their stay in the hospital or at a later date. This makes a total of 30 cases out of 464 in which positive skin tests were obtained following the recording of negative tests.

These men had not been in any other known endemic area for 30 days before the first coccidioidin skin test, or during the interval between the first and second coccidioidin skin tests.

In conclusion, the finding of 30 positive skin tests in "changeovers," with specific histories of not having been in other endemic areas, establishes the fact that the U. S. Marine Corps Air Station, Mohave, Calif., and vicinity is an endemic area for coccidioidomycosis.

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ACTION OF SUPERNATANTS FROM COMBINED GROWTH OF FUSARIUM SOLANI AND PSEUDOMONAS AERUGINOSA AGAINST THE TUBERCLE BACILLUS

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Ensign H(S) U. S. N. R.

The present report[1] concerns the activity of supernatants secured from the combined growth of a strain of Fusarium solani and a strain of Pseudomonas aeruginosa against the tubercle bacillus, Mycobacterium tuberculosis.

Culture of active organisms.—The fungal organism or fusarium is grown for 4 weeks in a shallow layer on a 1-percent hydrolysate of casein. To this is then added a suspension of pseudomonas culture. The pseudomonas is permitted to grow in the fungal culture for 2 weeks. At the end of this period, the supernatant from the combined growth of the two organisms is ready to be tested for activity against the tubercle bacillus.

Procedure of treatment of tubercle bacillus in vitro.—The mixture of fusarium and pseudomonas, of pH 7.45 (circa), was centrifuged until clear and mixed with an equal volume of a suspension of approximately 5 mg. per cc. of tubercle bacilli (H 37 strain). The resulting mixture was incubated for 12 hours at 37.5° C., and then set in the refrigerator for 36 hours. Suitable controls of bacillary suspension mixed with salt solution were run under the same conditions. The mixtures were then treated with 3-percent sodium hydroxide for 30 minutes at 37.5° C., and the resultant mixture was neutralized and cultured in the usual way for the isolation of tubercle bacilli by resuspending the sediment in a small amount of salt solution and seeding on Petroff's culture medium. The controls showed vigorous and normal growth.

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[1] The present investigation was begun at the Mountain Lake Biological Station of the University of Virginia, summer of 1940, under the supervision of Dr. Ivey F. Lewis, where an effort was made to ascertain the action of mycetozoan plasmodium against the tubercle bacillus. In late September of 1940, the work was carried to Harvard and undertaken while a Thayer Scholar, class of 1941, under the supervision of Professor William H. Weston, where the mold was isolated from the plasmodium. Later phases were accomplished at the Harvard Medical School, Department of Bacteriology, summer of 1941, where the bacterium was isolated. The problem was then carried to the University of Pennsylvania, Henry Phipps Institute, where the experiments outlined in the report were prosecuted under the direction of Dr. Esmond R. Long.

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Results of experimentation to date.—Experiment I consisted of testing the supernatants as they were obtained from the cultures; it was discovered that from 19 February to 10 March 1942 there was no growth of tubercle bacilli, and not until 24 March did a slight spindly growth appear. This weak growth continued until 22 April when the experiment was abandoned.

The results in experiment II were similar. From 20 February to 12 March 1942 there was no growth of tubercle bacilli, and by 24 March only a slight spindly growth appeared which continued as such to 22 April, when the observation was concluded.

Experiment III, set up on 3 March showed no growth up to 31 March, and only on 22 April was there a slight development.

The foregoing experiments were made at the Henry Phipps Institute. The experiments were duplicated in the bacteriologic laboratories of the Department of Botany, University of Pennsylvania, and similar results obtained. It was discovered, however, that a 24-hour incubation period increased the action of the active principle in the crude supernatants.

It now remains to isolate the active principle in pure form, or concentrate it to the extent that it can be stated quantitatively how many milligrams of active principle are being produced per cubic centimeter of crude culture, so that its true bacteriostatic or bactericidal nature can be determined and animal experiments carried out on a quantitative basis. It has been found that 1 cc. of the crude material injected into mice has no toxic effect.

A striking finding is that, tested separately, the supernatants from Fusarium solani and Pseudomonas aeruginosa, respectively, exert little or no apparent action against the tubercle bacillus. The experiment bears out the importance of considering interaction of organisms and their ultimate effect on pathogens. It bears out the principle that "there are no pure cultures in nature," and that for a complete understanding of the workings of the microbial world, and metabolic products produced thereby, a deep insight into the interaction of organisms is paramount.

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METRAZOL VERSUS ELECTROSHOCK

Metrazol is giving way almost completely to electric shock on account of the higher incidence of fractures with metrazol and the practical convenience of electroshock. Their exact mode of action remains a mystery but their effectiveness in dissipating and destroying the psychotic process in selected patients is an observable certainty.—HORNICK, E. J.: Shock therapies. Hawaii M. J. 4: 314–315, July–August 1945.

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SUSCEPTIBILITY OF SEROLOGICALLY TYPED GROUP A STREPTOCOCCI TO PENICILLIN

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Hemolytic streptococci (Streptococcus pyogenes) are highly susceptible, both in vitro and in vivo, to the action of penicillin (*1*). Since this group of pathogens is composed of a large number of serologically distinct organisms (*2*), it seemed of interest to study the degree of uniformity of penicillin susceptibility among different types of group A streptococci. Such observations might indicate whether certain group A strains or types possess natural resistance to this drug. In one study (*3*) no differences in penicillin sensitivity were detected among 18 strains of group A streptococci belonging to eight serologic types (1, 3, 10, 12, 17, 19, 30, 36). It is the purpose of this report to describe (1) a method of evaluating the susceptibility of group A streptococci to penicillin, and (2) the results obtained with a small number of serologically typed organisms.

Our observations were made on 25 strains of group A Streptococcus pyogenes, including representatives of eight serologic types (1, 3, 4, 12, 17, 19, 36, 41). The organisms were isolated from the throats of patients with scarlet fever or acute tonsillitis-pharyngitis on admission to the U. S. Naval Hospital, Treasure Island. Serologic identification was performed at the Streptococcal Typing Laboratory, National Naval Medical Center, Bethesda, Md. The bacteria actually tested for penicillin sensitivity were obtained from stock cultures stored on blood agar slants at 4° C.

To study the action of penicillin upon Streptococcus pyogenes, it seemed logical to use blood agar pour plates. If such plates are seeded with small numbers of organisms, streptococcus colonies grow readily and produce distinctive clear zones of complete (beta) hemolysis. It was believed that a pour plate method would not only indicate the numbers of colonies surviving the action of penicillin, but also the effect of the drug on the production of hemolysin and on colony characteristics. The hemolytic property of group A streptococci has been utilized in the assay of penicillin by other methods (*4*) (*5*) (*6*). With

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these the production of hemolysis is used as an indicator of bacterial growth.

The method described in this report involved the pouring of blood agar plates containing uniform inocula of group A streptococci and varying amounts of penicillin. A degree of inhibition of the growth of the organisms by the drug was estimated by comparing the numbers of colonies of the control plates with those surviving in the presence of penicillin after a standard period of incubation (18 hours). A single strain (T. I. No. 189), designated as the standard strain, was tested 15 times to indicate the variability of the results. The other strains were usually tested 2 or 3 times.

Preparation of pour plates.—One cubic centimeter of a 10^{-5} dilution of the strain being tested was placed in the central portion of each of the series of Petri dishes. To the inoculum in each dish, 1 cc. of penicillin solution was then added to obtain direct contact between the organisms and the drug. Within 2 or 3 minutes, exactly 10 cc. of melted blood agar, kept at 46° C. in a water bath, was added to each plate by means of a 10-cc. pipette. The agar was blown gently into the plate while slowly describing circles with the pipette to assist in the mixing of the organisms, penicillin, and culture medium. After the addition of the agar, the contents of each plate was thoroughly mixed by moving the plate in a figure 8 on the tabletop about 30 times. As soon as the agar had set, the plates were inverted and incubated at 37° C. for 18 hours. The plates were poured in groups of 8, including 2 controls and 2 plates for each of the 3 quantities of penicillin used in testing the organisms.

Penicillin quantities.—The susceptibility of the organisms was determined with a single lot of calcium penicillin diluted with sterile normal saline solution to contain 10,000 Oxford units per cubic centimeter. This solution was kept at 4° C. Prior to each series of tests, dilutions of the drug in normal saline solution were made up in large test tubes (50-cc.) and kept at 10° C. until just before being put into the plates.

The quantities of penicillin added to the plates were 0.15 unit, 0.1 unit, and 0.05 unit, respectively. These amounts were found to produce maximum and partial inhibition (50 percent) of strains of group A streptococcus that had been tested with 1 unit, 0.5 unit, 0.2 unit, 0.1 unit, 0.05 unit, and 0.025 unit. Since the plates contained a final volume of 12 cc., the quantities of penicillin per unit of medium were 0.0125 unit, 0.0083 unit, and 0.0041 unit per cubic centimeter. By using the three dilutions, minor variations in penicillin susceptibility were indicated. In the event that a particular strain was completely inhibited or totally uninfluenced by the amount of penicillin used, smaller or larger quantities of the drug could be introduced into the plates for a further titration.

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Preparation of organism suspensions.—A tube of tryptose phosphate broth (2 cc.) was inoculated with the growth on a blood agar slant and was incubated at 37° C. for 18 hours. If good growth (as indicated by a dense suspension of organisms) was obtained, the broth was used to prepare a dilute organism suspension in normal saline. If the growth seemed poor, a second tube was inoculated from the first and incubated for 18 hours. The need for this procedure was uncommon. The repeat tests were run on 18-hour broth cultures maintained for periods up to 1 week by daily subculturing in tryptose phosphate broth.

Reading the plates.—After 18 hours' incubation at 37° C., the numbers of colonies developing in the control plates and in those containing penicillin were counted with the aid of a Quebec colony counter. Since the control plates and those containing penicillin were poured in duplicate, the average of each pair was taken as the actual count. The degree of inhibition of the growth of the streptococci by the penicillin was calculated by determining the percentage of colonies surviving in the penicillin plates compared to the numbers of colonies in the control plates.

With the dilutions of organisms commonly used (10^{-5}) the control plate counts were usually between 100 and 300 colonies. As a rule the numbers of colonies of each of the control plates were comparable and the difference in counts was usually less than 10 percent of the average. In some instances, however, the variation between the 2 plates was from 20 to 40 percent of the average. The variations between each of a pair of plates containing a partially inhibiting amount of penicillin (0.05 unit) were usually similar.

The degree of correspondence in plate counts of a series of 8 pour plates inoculated with 1 cc. of a 10^{-5} dilution of hemolytic streptococci is shown in table 1.

TABLE 1.—*Number of visible colonies on pour plates seeded with 1 cc. of organism suspension (10^{-5})*

Plate No.	Colony count	Plate No.	Colony count
1	223	5	204
2	192	6	192
3	223	7	188
4	218	8	206

Culture media.—The agar medium was 4.5 percent Proteose No. 3 Agar (Difco) enriched with 0.3 percent Bacto Beef Extract (Difco) and was prepared in 300-cc. amounts. The pH of the enriched medium was 7.3. After the sterile agar had been melted and cooled to 46° C., sufficient fresh sheep blood (33 cc.) was added to make a con-

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centration of 10 percent. Since the plates also contained 2 additional cc. of saline solution (organism suspension and penicillin), the final blood concentration in the poured plates was 8 percent.

The tryptose phosphate broth was prepared by dissolving 29.5 gm. of Bacto-Tryptose Phosphate Broth (Difco) in 1,000 cc. of distilled water. The pH of the sterilized medium was 7.3.

RESULTS

The results of determinations of the penicillin sensitivity of 25 strains of group A Streptococcus pyogenes are shown in tables 2 and 3. Table 2 shows the uniformity of the responses to penicillin of the standard strain tested on 15 different occasions. This strain was always completely inhibited by 0.0125 unit of penicillin per cubic centimeter of blood agar, and in 75 percent of the tests was completely inhibited by a dose of 0.0083 unit per cubic centimeter. In the remaining tests the degree of inhibition varied from 96 to 99.2 percent. In view of this latter fact, it seemed likely that the minimal dose for complete inhibition lay close to 0.0083 unit per cubic centimeter.

TABLE 2.—*Responses of a single strain of Group A streptococcus (type 19)*[1] *to small amounts of penicillin*

Date of test	Organism dilution	Control plate count	Percentage inhibition of visible colonies per quantity of penicillin		
			0.15 unit	0.1 unit	0.05 unit
9-11-44	10^{-4}	3,250	100	99.2	44.0
9-12-44	10^{-5}	18	100	100.0	50.0
9-13-44	10^{-5}	285	100	100.0	44.5
9-24-44	10^{-5}	212	100	100.0	42.0
9-25-44	10^{-5}	146	100	98.7	33.6
9-26-44	10^{-5}	233	100	100.0	47.6
9-27-44	10^{-5}	140	100	100.0	45.8
9-29-44	10^{-5}	124	100	100.0	76.3
11-12-44	10^{-5}	180	100	100.0	36.2
11-19-44	10^{-5}	309	100	96.0	40.5
11-21-44	10^{-5}	325	100	100.0	42.1
11-23-44	10^{-5}	600	100	100.0	31.4
11-24-44	10^{-5}	478	100	100.0	32.0
11-28-44	10^{-5}	232	100	100.0	40.0
11-30-44	10^{-5}	201	100	100.0	45.3
Mean			100	99.6	43.4

[1] T. I. 189.

The smallest quantity used in the tests, 0.0041 unit per cc., invariably produced some degree of partial inhibition of the strain. The degree of inhibition by this amount of penicillin ranged from 31.6 to 76.3 percent, but in 66 percent of the tests the inhibition varied from 40 to 50 percent. The mean inhibition of the strain by 0.0041 unit was 43.4 percent, with a standard deviation of ±10.3 percent. It is interesting that the usual degree (40 to 50 percent) of inhibition pro-

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duced by this amount was approximately one-half that of the next larger amount (98 to 100 percent).

TABLE 3.—*Comparison of the responses of 24 serologically typed Group A streptococcus strains to penicillin*

Serologic type	Strain No.	Organism dilution	Control plate count	Percentage inhibition of visible colonies per quantity of penicillin		
				0.15 unit	0.1 unit	.05 unit
19	243	10^{-5}	58	100	100.0	50.0
19	243	10^{-5}	130	100	100.0	52.0
19	192	10^{-6}	101	100	100.0	58.0
19	192	10^{-5}	240	100	100.0	39.6
19	259	10^{-5}	277	100	100.0	49.5
19	259	10^{-5}	77	100	98.7	11.7
19	259	10^{-5}	142	100	100.0	13.4
19	225	10^{-5}	122	100	100.0	46.8
19	225	10^{-5}	91	100	100.0	28.5
19	225	10^{-5}	102	100	100.0	64.7
19	191	10^{-5}	218	100	92.7	40.9
19	191	10^{-5}	141	100	100.0	49.7
19	400	10^{-5}	250	100	100.0	84.0
19	373	10^{-5}	165	100	100.0	88.0
19	373	10^{-5}	98	100	100.0	50.0
19	398	10^{-5}	307	100	100.0	65.0
19	398	10^{-5}	148	100	100.0	34.9
19	364	10^{-5}	142	100	100.0	52.0
19	402	10^{-5}	1,281	74	23.0	15.0
19	402	10^{-6}	198	100	56.0	0.0
17	193	10^{-4}	762	100	98.3	59.5
17	193	10^{-5}	182	100	100.0	56.0
17	208	10^{-4}	759	100	91.7	20.0
17	208	10^{-5}	250	100	99.9	40.8
17	223	10^{-5}	228	100	100.0	49.2
17	223	10^{-4}	1,109	100	99.5	41.7
17	410	10^{-5}	215	100	100.0	57.0
17	388	10^{-5}	88	100	100.0	80.0
17	388	10^{-5}	238	100	100.0	86.6
3	220	10^{-4}	1,812	100	99.0	33.0
3	220	10^{-6}	43	100	97.7	60.5
3	220	10^{-5}	207	100	97.6	40.5
3	201	10^{-5}	243	100	100.0	97.6
3	201	10^{-5}	270	100	100.0	81.1
1	190	10^{-4}	740	100	94.9	22.0
1	190	10^{-4}	1,562	100	99.9	22.0
1	190	10^{-5}	165	100	100.0	23.0
1	217	10^{-5}	374	100	96.3	63.6
1	217	10^{-4}	1,213	100	95.9	31.8
1	217	10^{-5}	250	100	95.2	42.8
1	424	10^{-5}	315	100	80.0	0.0
1	424	10^{-5}	467	100	88.9	18.6
12	204	10^{-6}	72	100	96.6	28.0
12	204	10^{-5}	273	96.7	77.6	0.0
12	204	10^{-5}	226	100	93.8	19.5
12	204	10^{-5}	234	94.5	83.4	9.0
4	423	10^{-5}	745	100	100.0	51.0
4	423	10^{-5}	250	100	100.0	32.8
36	499	10^{-5}	212	100	100.0	97.2
41	461	10^{-5}	303	100	66.0	0.0
41	461	10^{-5}	765	100	77.0	17.0

Table 3 compares the responses of 24 other strains of group A streptococci belonging to 8 serologic types with those of the standard strain. Twenty strains manifested the same degree of penicillin susceptibility as the standard strain. Two of these strains (Nos. 201 and 499), however, may have been somewhat more susceptible to

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penicillin than the standard strain, as they were almost completely inhibited by the 0.0041 unit per cubic centimeter. On the other hand, 4 strains (Nos. 204, 402, 424, and 461) seemed to be slightly more resistant to penicillin than was the standard strain. One of these (No. 402) required 0.016 unit per cubic centimeter for complete inhibition on one occasion, and the other (No. 204, Type 12) was incompletely inhibited by 0.0125 unit in 2 of 4 tests.

In all the tests the degree of inhibition by each different quantity of penicillin persisted as a rule for 24 hours after the initial reading. In some instances, at 42 hours a small number of colonies which had showed complete inhibition at 18 hours developed in the plates containing 0.1 unit of penicillin but not in those with 0.15 unit. Colonies failed to develop on the latter plates, which were observed daily for 1 week. The plates containing 0.05 unit showed only slight increases in the 42-hour plate counts.

In all plates showing partial inhibition (less than 100 percent), the colonies were commonly reduced in size and were surrounded by narrower zones of beta hemolysis, when compared with the controls. The



1. Control blood agar plate seeded with 1 cc. of a 10^{-5} suspension of Group A streptococci (strain No. 259, Type 19) after 48-hour incubation.

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2. The effect of 0.05 unit of penicillin in a blood agar pour plate seeded with 1cc. of a 10^{-5} suspension of Group A streptococci (strain No. 259, Type 19) and after 48-hour incubation. Compare with control (fig. 1) for colony number and size, and the width of the hemolytic zones.

difference was maintained for a period of several days and is shown in figures 1 and 2.

No consistent changes in colonial morphology were apparent. All the plates contained variable numbers of small compact and larger spreading colonies.

COMMENT

The results obtained in this study indicate that natural variations in penicillin sensitivity were slight or inapparent among 25 strains of group A streptococci belonging to 8 distinct serologic types. The failure to observe any gross differences in the penicillin sensitivity of these organisms is in accordance with previously reported observations (*3*). According to Garrod (*7*) no penicillin-resistant strain of Streptococcus pyogenes has been encountered.

With the method used, the amounts of penicillin required to produce complete inhibition of the growth of hemolytic streptococci were comparable to those determined by others. According to Rammelkamp

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and Keefer (*8*), various strains of Streptococcus pyogenes are killed by concentrations of 0.0009 to 0.0156 unit of penicillin per cubic centimeter of veal infusion broth. The group A strains tested by Watson were completely inhibited by 0.0156 unit of penicillin. Although we used larger total amounts, most of the strains were completely inhibited by an amount of penicillin between 0.0082 and 0.0125 unit per cubic centimeter of blood agar. By the method of Rake and Jones, the growth and hemolysin production of hemolytic streptococci were prevented by a quantity of the drug between 0.03 and 0.05 unit in a volume of 2.3 cc.

SUMMARY

1. A method for studying the action of penicillin on group A streptococci in blood agar pour plates is described.

2. With 23 of the 25 strains tested, an amount of penicillin between 0.15 and 0.1 unit per plate (0.0125 and 0.0083 per cc. of blood agar) prevented the development of visible colonies for 18 hours.

3. Only minor variations in penicillin sensitivity were noted among representative strains of eight serologic types of group A streptococci.

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ELECTRIC OPHTHALMIA

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Over a period of 3 months a total of 47 cases of flash burn of the eyes, or electric ophthalmia, were treated aboard a repair ship. During this time an abnormally large amount of welding was done in making emergency and battle-damage repairs to various ships, which partially accounts for the large number of cases.

The greater number of cases occurred in shipfitters and other men working in the immediate vicinity of the welders, usually only a few feet away. There were no cases in men who had worn protective goggles or hoods whenever welding was being done. All the cases were in men who had momentarily removed their goggles at the time that an arc was struck, or in those who did not use goggles while at work. This practice was particularly prevalent at night when the visibility of the material being worked upon was much less. In only five instances did such burns occur in welders; in one instance they resulted when a welder lifted his hood, and in another when the welder nearby struck an arc.

There were seven men who sustained a second burn during this period, and there were two cases of a third burn resulting.

The main complaint was a burning sensation or pain in one or both eyes, which was frequently accompanied by a feeling of having a foreign body in the eye. Photophobia, lacrimation, and blepharospasm were pronounced in many cases.

The findings were principally a mild to severe injection of the conjunctiva, and more especially an episcleral injection. In five instances there was considerable edema of the eyelids, upper and lower. In six men there was evidence of pseudopterygium with accompanying injection. Superficial ulceration of the cornea was present in two cases.

The interval between exposure to the welder's arc which caused the burn and the time of reporting for treatment varied between 30 minutes and 36 hours. In most instances from 4 to 10 hours elapsed after exposure before the appearance of symptoms.

Treatment consisted of irrigation of the eye with mild boric acid solution, and instillation of a solution containing pontocaine hydrochloride and neosynephrin hydrochloride. In many instances an ointment containing 2-percent butyn sulfate was also employed. Relief

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was obtained, especially when there was edema of the lids, by application of cool boric acid compresses. The response of all cases to therapy was prompt; in many men all signs and symptoms had disappeared within 24 hours, and in only three cases was there any inflammation present after 48 hours of treatment. One man required a moderate amount of codeine and barbiturates for 1 day.

About one-third of the patients were removed from duty for a 24-hour period, but none required admission to the sick list.

An observation which might be made from this survey is that the problem is one of prevention. Goggles and hoods give adequate protection against flash burns of the eyes.

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GASTRIC JUICE IN TREATMENT OF ULCER

The gastric juice of normal volunteer subjects was fed to a series of patients with uncomplicated peptic ulcer. The normal gastric juice was neutralized, filtered, and preserved with tricresol. Relief of peptic ulcer symptoms resulted.—MORRISON, L. M.: Peptic ulcer disappearance after feedings of normal human gastric juice. Am. J. Digest. Dis. 12: 323–327, October 1945.

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PRESENT TRENDS IN MEDICINE

There seems no doubt that a man's physical state affects his feelings and his behavior, and conversely that his feelings and his behavior affect his physical state. The disturbances of disease and the corrective efforts of therapeutics can work in either direction. "Organic" and "functional" are no longer distinct; still less are they synonymous with "important" and "unimportant." This principle is not to be taught in a short specialist course on psychologic medicine; if it is accepted as sound, it must pervade the wards, the outpatient department, the lecture rooms, and the examinations. As yet the issue has not been squarely faced. The profession as a whole has not fully realized that if it undertakes to treat patients whose disorders are psychogenic, it must attempt to influence their feelings and their behavior. It must learn how to "move" people, their minds, not just their bowels. It must concern itself with their morals and their religion, not merely as tolerant observer but as operator. Medicine indeed is likely to find itself charged with a role that has hitherto been accorded to the church. If so, the implications for medical education are heavy.—AITKEN, R. S.: Teaching of medicine. Lancet 2: 225–229, August 25, 1945.

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THE DETECTION OF MALINGERING: A FURTHER STUDY

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For the purposes of this discussion malingering will be limited to the conscious, willful simulation of some psychopathic disturbance. It can be further divided into two general types: Asymptomatic malingering, which occurs in normal persons whose personality structure shows no evidence of basic psychopathosis; and symptomatic malingering, which occurs in individuals who are basically psychopathic. In this latter type the malingering must be considered a function of the underlying personality difficulty.

Asymptomatic, sometimes called "pure" malingering, occurs infrequently in the military services and is easily handled. In general it may be characterized as follows: (1) It occurs in normal persons; (2) it occurs only when encouraged by the social situation; (3) it is not carried to extremes involving severe social consequences for the malingerer; and (4) it is easily treated.

Such asymptomatic malingering is apt to appear in a poorly motivated but psychologically healthy recruit when an externally created opportunity, such as a periodic medical examination or regular sick call, presents itself. Since the malingerer is in normal contact with his social environment, he is unwilling to press his simulation to the point where his actions involve him in serious consequences either of a disciplinary or medical nature. He can usually be brought into line by a few carefully chosen remarks from the medical examiner. As he has the normal person's accessibility to social pressure, group morale can be used in controlling him. Such asymptomatic malingering is always conscious.

Two illustrations from the author's experience at a large Naval training station are apropos. Recruit A was somewhat poorly motivated toward the war effort and loath to leave the comforts of a civilian environment. When interviewed during the regular recruit re-examination upon his arrival at the training station, he proceeded to build up an elaborate story of severe, incapacitating headaches. Neither the work history, the social history, nor his description of his symptoms fitted his claim of incapacitation. Instead of accusing him of lying, the examiner mildly remarked that his headaches did not seem to be as bad as he thought they were, and sent him on to duty. When

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seen 3 weeks later, the recruit had no somatic complaints, was doing well in his recruit company, and remarked that the Navy was fine and that his shipmates were "swell fellows."

Recruit B gave a history of childhood head injury with no sequelae. He was sent to duty and a social history was obtained which was negative. When he was called in automatically for re-examination at the end of 3 weeks of training, however, he gave a lengthy and impassioned history of nervous instability. The story was palpably false, and gentle probing by the examiner produced a confession and the statement that several letters from home had produced some nostalgia. His homesickness was discussed with him and he was returned to duty. When seen again at a later date, he was happy and stated, "Nothing could get me to leave the Navy."

Symptomatic malingering is more frequent and poses a more serious problem. It is characterized as follows: (1) It occurs in an abnormal person suffering from some basic psychopathosis; (2) it manifests itself without encouragement from the social environment; (3) the individual will carry it to extremes often involving serious medical or disciplinary consequences; and (4) it can be handled only by getting at the basic psychopathosis and treating that. Such symptomatic malingering is found particularly in the psychopaths, neurotics, and psychoneurotics. Such conscious, willful simulation grades over insensibly into the unconscious mechanisms of hysteria. Brill and Farrell have discussed this (*1*).

The detection of malingering is based upon the fact that the malingerer is not familiar with the complete picture of the disease he is simulating and hence is unable to duplicate it. This offers an ideal opportunity for the psychologist with his testing technics. We have compared the typical intelligence test responses of a control group of known mentally deficient persons with those of an experimental group of malingerers attempting to simulate mental deficiency (*2*). The test picture is quite different in the two groups, as the malingerer tends to fail more of the easy items and pass more of the difficult items than the mental deficient does. Goldstein has used this demonstrable difference as the basis for evolving a scoring stencil for detecting malingering on the Army's Visual Classification Test (*3*).

In view of the known tendency of psychotics to show "scatter" in their performance on intelligence tests, the question arises as to whether or not such scatter resembles that shown by malingerers, or whether the malingering performance can be distinguished from the psychotic picture as well as the mentally deficient one. Goldstein has also raised this question and suggests that such a tendency may be present and act to invalidate his malingering stencil.

In order to check this, the two tests used in the previous malingering study were administered to 50 known psychotics. Thirty of these were

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old, chronic cases in a custodial institution, and 20 were milder, recent cases still under observation and therapy. The tests were an Arithmetical Reasoning test consisting of 10 arithmetic problems, and an Easy Directions test containing 20 simple tasks to be carried out on the test paper. Both were written tests with a 2-minute time limit.

Tables 1 and 2 show the results in terms of percentage of the group passing each item and compare them with the previous groups of malingerers and mental deficients. It will be seen that the responses of the psychotics do differ from those of the malingerers and represent a J-shaped distribution, gradually dropping off as the difficulty of the items increases or the time limit is approached. The significant thing is that this distribution does not show the major inversions typical of the malingering distribution. It is not that individual psychotics do not scatter, but that the group as a whole does not show the malingerers' pronounced tendency to overestimate or underestimate the difficulty of *certain* items.

TABLE 1.—*Percentage of malingerers, feebleminded and psychotic passing each item on Arithmetic test*

Item	Malingerers N=45	Feebleminded N=45	Chronic schizophrenic N=30	Mild schizophrenic N=20
1	44	51	87	75
2	27	47	67	80
3	42	33	63	70
4	27	9	33	40
5	29	4	40	35
6	24	4	27	25
7	7	0	13	15
8	11	0	3	10
9	9	0	7	5
10	9	0	7	5

The paper and pencil personality tests, or neurotic inventories, at present being used as screening tests for neuropsychiatric selection in the military services, offer another opportunity for malingering. Such tests usually consist of a collection of brief items covering significant autobiographic material as well as current symptoms. The questions are relatively undisguised, and it is easy for the subject to grasp their purport and control his responses accordingly. It has been the experience here, however, that despite such insight into the purposes of the test, most malingerers overplay their hand and appear so much worse on the test than the truly psychopathic individual that they are immediately obvious.

In order to check this observation, an experiment was performed in which 87 enlisted men, all free of neuropsychiatric defect, were given the personality inventory used as a screen test at a Naval training station (*4*). The inventory consisted of two parts printed on the op-

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TABLE 2.—*Percentage of malingerers, feebleminded and psychotics passing each item on Easy Directions test*

Item	Malingerers N=45	Feeble-minded N=45	Chronic schizophrenic N=30	Mild schizophrenic N=20
1	69	51	70	75
2	62	38	80	65
3	56	18	63	65
4	56	33	60	70
5	27	69	70	75
6	29	20	50	65
7	22	56	63	70
8	36	53	57	70
9	67	62	60	65
10	60	56	60	60
11	38	9	43	60
12	18	7	23	45
13	38	7	30	35
14	20	4	33	35
15	24	4	30	25
16	16	2	10	25
17	11	0	10	20
18	13	0	3	20
19	9	0	7	15
20	0	0	7	10

posite sides of a single sheet of paper. One side contained 32 items from the well-known Cornell Selectee Index covering common neurotic symptomatology such as use of dope, tendency to headaches, bed-wetting, etc. The other side contained 20 items from the Shipley Personal Inventory. These are forced-choice items covering the same general ground as the Cornell Selectee Index but in a slightly more disguised form. The subjects were instructed to imagine they were "gold brickers" attempting to malinger their way out of the Navy and to answer the test questions accordingly.

The responses of this group of malingerers were then compared with those of a control group of 54 men discharged from the Navy for neuropsychiatric reasons. The papers were scored for total number of "bad" answers on the Cornell Selectee Index (C. S. I.), total number of "stop" (or particularly significant) questions answered incorrectly on the C. S. I., and the total number of "bad" answers on the Personal Inventory (P. I.).

Table 3 summarizes the results and demonstrates that the malingerers do score much higher than the true psychiatric group. The mean score on the C. S. I. for the malingerers was 18, for the psychopathic group 5.4. The mean "stop" question score for the malingerers on the C. S. I. was 6.5; for the psychopathic group it was 1.3. The mean score on the P. I. for the malingerers was 13.6, and for the psychopathic group 8.6. As the critical ratios show, all these differences are statistically reliable to a high degree.

It must be stressed, however, that this difference is a group difference, and while most members will follow the group trend, occasional individual malingerers will be found who do not show this tendency

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TABLE 3.—*Inventory mean scores of malingerers and dischargees with critical ratio of differences*

	Malingerers N=87	Dischargees N=54	Critical ratio of difference
C. S. I. total score	18.0	5.4	13.5
C. S. I. "stop"	6.5	1.3	5.8
P. I	13.6	8.6	6.2

to score unduly high. Some will even be found who score zero, or unduly low, apparently feeling that such obvious covering-up behavior is equally apt to call psychiatric attention to them. Item analysis reveals that the differences between the two groups are quantitative rather than qualitative. There is no tendency, as there is in intelligence tests, for certain items to be chosen by different groups.

These experimental results support the author's clinical experience that malingering is relatively easy to detect on psychologic tests. Even when the item is easily seen through, and when the malingerer feels in full control of the situation, he is unable to duplicate with any exactness the true behavior picture of the group he is imitating.

Both these situations involve testing materials which are familiar to the malingerer, and this familiarity leads him into the false confidence that he can control his responses to conform to the clinical picture he is simulating. It is interesting to consider what happens in a relatively unfamiliar testing situation, such as the interpretation of the Rorschach ink blots. While no results are available for an experimental group on the Rorschach test, the author has administered this to many malingerers.

In opposition to the response in testing situations involving intelligence tests and personality inventories, the response of the malingerer to the ink blots is one of extreme caution. The response picture is marked by a general paucity of responses, the rejection of numerous cards, an unduly large number of popular responses, and some perseveration or repetition of previous responses. The bizarre and unusual is seldom seen. This confirms Benton's experience (*5*). The picture is one of an insecure individual proceeding in a strange situation with great caution. Unfortunately the same response picture is often seen in neurotics and anxiety subjects, perhaps because of the similarity of the psychologic elements determining the subject's behavior.

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MISUSE OF MORPHINE

Evidence is mounting that morphine has a single legitimate use; namely the relief of severe pain, a view that is widely accepted but too little put into practice, says Henry K. Beecher, consultant in anesthesia and resuscitation, Mediterranean Theater of Operations. Causes of morphine misuse or overdosage, according to him are:

1. Failure to appreciate that nearly the safe maximum analgesic effect of morphine can be produced by ¼ grain and that ½ grain can produce serious depression in small persons or those whose tolerance may have been lessened by wounds. An otherwise modest dose may become an overdose in a given case.

2. Failure to realize that subcutaneous injections of morphine will be only poorly absorbed, if at all, when the peripheral circulation is sluggish or inactive, as a result of cold or low systemic blood pressure. Failure to get pain relief from the unabsorbed morphine leads to the administration of a second or third dose, all of which may be absorbed at one time when the peripheral circulation is re-established as a result of resuscitative measures.

3. The incorrect belief that extensive wounds are inevitably associated with severe pain often leads to needless use of morphine. At Anzio, only a quarter of the severely wounded patients said, in response to a direct question, that they were having enough pain to want pain relief medication.

4. Administration of morphine for conditions that will not respond satisfactorily to the agent, however large the dose, is a common error. Specifically, the use of morphine to treat the restlessness associated with bleeding, with anoxia, or with hysteria cannot be soundly defended. The use of morphine in shock, except for the treatment of severe pain, is contraindicated. Morphine is occasionally administered when other agents (barbiturate sedation, for example) are far better.—BEECHER, H. K.: Editorial: Misuse of morphine as therapeutic agent. Surg., Gynec. & Obst. 81: 461–462, October 1945.

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MENTAL HEALTH OF MEN DISCHARGED UNDER THE POINT SYSTEM

A PRELIMINARY NOTE

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Routine psychiatric screening of men discharged from the Navy is not uniformly required as is the psychiatric examination of men entering the service, and experience at this activity does not indicate that there is any urgent need for the extremely careful psychiatric examination which, in the case of recruits, aimed at keeping out the unfit.

At this activity, which has been a separation center for a west coast Naval district for many months, the psychiatrists have seen men discharged for a great variety of reasons—inaptitude, overage, underage, convenience of the government, bad conduct, undesirable, and, in the case of servicewomen, pregnancy. When the point system was announced for the separation of general Naval personnel from the service, there was some local curiosity as to the types of men being discharged and their general mental health. The senior medical officer initially required the psychiatrists to add a short note to the form Y, commenting on the incidence of abnormal psyche. To assist in getting objective data on a large number of men to supply this information, recourse was had to the standard personality inventories.

The routine use of the Wilkins-Miles Self-Description Inventory for over a year at this activity was prompted by the fact that the inventory was standardized so that there was a maximum of simplification, all questions puzzling to literates of the mental age of 11 years or less being excluded. The routine use of this inventory on all dischargees over a year's period supplied the psychiatrists with certain "stop" questions which were found to be critical questions with survivors of ship sinkings and with men being discharged to civil life. Average time of administration of the SDI has been found to be 14 or 15 minutes whether administered in groups or individually.

The need for a much shorter form became paramount when the large number of separatees began to arrive, and this led the psychiatrist to construct a form which could be completed in little more

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than a minute, required minimal directions, and could be scored by scrutiny. The questions finally selected on the basis of this psychiatric consensus were:

	Age	Rank or Rate	
(Last name) (First name)			
1. How long have you been in the service? (months)			
2. How long overseas? (months)			
3. How many major engagements?			
4. Do you usually feel well and strong?		YES	No
5. Do you often have indigestion or stomach trouble?		YES	No
6. Do you ever have any dizzy spells?		YES	No
7. Did you ever have any nervous trouble before entering the service?		YES	No
8. Have you had any nervous trouble since entering the service?		YES	No
9. Do you have headaches as often as once a month?		YES	No
10. Are you happy and sad by turns without knowing why?		YES	No
11. Are you ever bothered by the feeling that people are reading your thoughts?		YES	No
12. Do you sometimes have a feeling that things around you are not real?		YES	No
13. Are you in just as good health as when you came into the service?		YES	No

Items 1 through 3 are for the general orientation of the psychiatrist. Items 4 through 13 are answered merely by encircling the YES or No. Items 4 and 13 should be answered YES; all the remaining items should be answered No. Any deviation from this is considered an unhealthy response and can be told at a glance at the sheet. The questionnaire has some space at the bottom of the sheet for additional notes by the psychiatrist which he may wish to make during the interview. This brief questionnaire was administered to the first thousand men separated under the point system, a group which included 131 officers and 869 men. This is considered to be a representative sampling of men being discharged. The median number of months of active duty was 43 (Q_3 of 52 months; Q_1 of 35.4 months). The number of major engagements participated in by these men in general followed a J-curve, with a mode of zero but a range up to 15 major engagements.

TABLE 1.—*Number of unhealthy responses by separatees on the short questionnaire*

Number of responses	Officers	Men	Total	Percentage
0	95	478	573	57.3
1	19	192	211	21.1
2	13	111	124	12.4
3	3	39	42	4.2
4	1	26	27	2.7
5	0	15	15	1.5
6	0	6	6	.6
7	0	1	1	.1
8	0	1	1	.1

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The great majority of these men had surprisingly few complaints which could be considered of psychiatric significance. The total number of unhealthy responses for the group is shown in table 1. Fifty-seven percent had no unhealthy responses; nearly four-fifths had only one such response; nine-tenths had only two. No difference between officers and men could be noted.

TABLE 2.—*Specific responses checked by separatees*

Item No.	Officers	Men	Total	Percentage
4. Feel well	0	12	12	1.2
5. Stomach trouble	3	83	86	8.6
6. Dizzy spells	4	72	76	7.6
7. Nervous before entry	2	22	24	2.4
8. Nervous since entry	9	133	142	14.2
9. Headaches	16	186	202	20.2
10. Mood shifts	5	58	63	6.3
11. People reading your thoughts	0	12	12	1.2
12. Feeling of unreality	3	21	24	2.4
13. Good health	15	167	182	18.2

The specific responses which these men were likely to check can be noted in table 2. Twenty percent complained of headaches, but psychiatric interview, which of course was focalized by the particular items checked, showed that these headaches were crippling in extremely few cases and in no instance required hospital observation. Eighteen percent felt that their health was not quite as good as when they entered the service. Fourteen percent complained of some nervousness, but this turned out, in the next interview, to be vague and certainly insufficient to hold up a man's return to civil life.

It is significant that the stop questions aimed at detection of possible schizoid trends were so infrequently checked; items 11 and 12 were checked by only 1 and 2 percent. Again psychiatric interview indicated that none of these complaints were of deep psychiatric significance. Not a single psychotic was detected through the psychiatric interview, and not a single officer or man was transferred to the local Naval hospital for disposition or more extended observation.

In the case of functional complaints, entry was made on the terminal form Y, but no man was thought to be in such a mental state that his discharge need be held up even so much as a day. These data suggest that the mental health of the ordinary separatee is very good indeed, considering length of service, amount of time spent in combat, and so on. Whether such a conclusion is valid or not only time can tell.

Comparative data upon a group not quite so stable at the time of their being seen by the psychiatrists are presented in tables 3 and 4, wherein the number of items checked by the survivors of a heavy cruiser

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TABLE 3.—*Number of unhealthy responses by survivors on the short questionnaire*

Number of responses	Number of unhealthy responses	Percentage	No. of responses	Number of unhealthy responses	Percentage
0	53	19.2	5	18	6.6
1	56	20.2	6	16	5.5
2	59	21.3	7	4	1.4
3	35	13.9	8	1	0.4
4	29	10.7	9	1	0.4

TABLE 4.—*Specific responses checked by survivors*

Item No.	Number of unhealthy responses	Percentage	Item No.	Number of unhealthy responses	Percentage
4. Feel well	16	5.9	10. Mood shifts	88	32.3
5. Stomach trouble	50	18.4	11. People reading your thoughts	25	9.2
6. Dizzy spells	90	33.1	12. Feeling of unreality	47	17.3
7. Nervous before entry	20	7.3	13. Good health	89	32.7
8. Nervous since entry	86	31.3			
9. Headaches	111	40.8			

are shown. This particular cruiser went down very quickly, and the total number of casualties was great, being tentatively estimated at two-thirds of the ship's complement. The survivors spent 5 days in the water before being rescued. Upon arrival in the United States, they were routinely screened by the psychiatrists, who found in their individual interviews precisely the differences shown in the tables.

These 272 men represent a group which had undergone severe psychic trauma as a climax to rather severe combat duty and experience. Only 19 percent had no unhealthy responses upon the questionnaire. The group is significantly different from the separatees, but this is to be expected, considering the recency of the traumatic experience.

The specific complaints of the survivors are shown in table 4. Clinical impressions of mild depression and fatigue on this group are borne out by the items checked on the short questionnaire. Twice as many survivors as separatees complained of bad headaches; over four times as many complained of dizzy spells; and twice as many complained of nervous trouble. Differences on items 11 and 12 also appear to be of significance, and yet only two men were held over because of these items, and they were allowed to go on leave the next day.

In the case of survivors, the examining psychiatrist, feeling that leave is one of the best of therapies, tried to get every survivor to his home and to the beneficial environment presumed to exist there. Very frequently a man was sent on survivor's leave, with the object of the man's benefiting from his leave and then reporting for psychotherapy at his station.

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SUPPRESSION OF EARLY SYPHILIS BY SUBTHERAPEUTIC DOSAGE OF PENICILLIN

REPORT OF A CASE

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Recent reports on the modification of early manifestations of syphilis have justified the admonition that penicillin therapy for gonorrhea might mask or delay the signs of simultaneously acquired syphilis. The original report of the Penicillin Panel of the Subcommittee on Venereal Diseases of the National Research Council (*1*) demonstrated that the incidence of relapse in syphilis, when penicillin is administered, is in direct relationship to the total dosage given by the intramuscular route in 7½ days, greatest with 60,000 units and least with 1,200,000 units.

The purpose of this report is to demonstrate the delay in diagnosis resulting from the use of 200,000 units of penicillin in an effort to treat an inguinal adenitis.

Case report.—A 31-year-old white male reported on 6 November 1944, complaining of a penile "haircut" of 1-week duration. Examination revealed an almost completely healed, small superficial erosion at the insertion of the frenulum onto the glans penis, accompanied by a balanoposthitis and a small, nontender, firm, discrete, right inguinal adenitis. A darkfield examination for Treponema pallidum, and blood Kahn and Frei tests yielded negative results.

On 9 November the patient was admitted to the sick list with a diagnosis of balanoposthitis. Material from the area of the healed penile lesion was resubjected to darkfield microscopy but failed to reveal Treponema pallidum. Blood Kahn and Frei tests were again negative. On questioning, the patient repeatedly denied extramarital exposure, and his wife, who was in the second month of pregnancy, revealed neither laboratory nor clinical evidence of syphilis. On this day the patient was given 4 gm. of sulfathiazole. When this was followed on the next day by fever and a macular toxic eruption, the drug was discontinued.

Two days later the left inguinal lymph nodes had enlarged to walnut-size and were firm and tender, while the right inguinal nodes were peanut-size and nontender. Kahn and Frei tests were again negative. By 13 November swelling of the glands was subsiding and the balanoposthitis had improved. The patient was discharged to duty with instructions to report for observation.

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The patient returned 1 week later because the inguinal adenitis had become recrudescent, but there was no evidence of a penile lesion. The result of a blood Kahn test was again negative. He was readmitted, and on 23 and 24 November he received a total dose of 200,000 units of penicillin by intramuscular injection. Observation revealed no change in the inguinal lymph nodes. Blood Kahn tests repeated on 12 and 20 December were negative. A heterophil antibody reaction on 12 December was within normal limits.

Biopsy of one of the left inguinal glands revealed a granulomatous lymphadenitis. Administration of sulfanilamide, 1 gm. four times a day, was started and continued for 4 days without untoward reaction. On 26 December, Frei, Kahn, and von Pirquet tests were negative, and the patient was discharged to duty on 28 December.

On 18 January 1945 a superficial penile lesion reappeared at the same site as the original erosion. Darkfield examinations repeatedly failed to reveal Treponema pallidum and a blood Kahn test yielded negative result. On 2 February the penile eruption became more marked and a crop of pustular lesions appeared over the symphysis pubis, upper thighs, and lower abdomen. Three days later blood was drawn for a Kahn test and the patient was referred for consultation.

When the patient was seen in consultation on 6 February there was a papular, edematous eruption on a redundant, unretractable prepuce, and disseminated over the shaft of the penis, groins, thighs, legs, and lower abdominal wall was a papulopustular infiltrated eruption. In addition a typical maculopapular eruption of secondary syphilis could be seen evolving over the trunk. The mouth, palms, soles and scalp were clear. The inguinal lymph nodes were enlarged, nontender, and discrete on the right side, but the left inguinal glands were matted, slightly tender, and formed a mass of walnut size. The cervical lymph node chains were palpable, but the epitrochlears were not.

Darkfield examination of material from one of the new maculopapular lesions on the abdominal wall revealed many treponemata, and on the following day the blood Kahn test was reported to be strongly positive. When confronted with the specific diagnosis, the patient recalled an evening of inebriety, during the first week in October 1944, while on duty outside the United States, but could not recall extramarital exposure.

The cutaneous eruption and lymphadenopathy responded rapidly to the administration of 2,400,000 units of penicillin. Fortunately the patient's wife, with whom he had had no sexual relations since November and who was in her fifth month of pregnancy, revealed no clinical or laboratory evidence of syphilis at this time.

COMMENT

In reviewing the chronology of this case it is reasonable to assume that the original penile lesion was a resolving syphilitic chancre. Unfortunately, repeated laboratory examinations were negative, and the patient denied extramarital exposure. That the penicillin, administered approximately 24 days after the appearance of the penile lesion, delayed the immunologic response is probable, a minimum of 54 days elapsing between the penicillin therapy and the last negative blood finding.

It is of interest to note that, in the case reported by Canizares (*2*), 50,000 units of penicillin delayed the recurrence of a chancre for 3

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weeks; in Ricchiuti's (*3*) case, the chancre did not reappear, but 16 days after therapy with 100,000 units of penicillin, the blood Kahn test became strongly positive. In the case reported by Boyd, Wagner and Hewson (*4*), chancres reappeared 3 weeks after administration of 80,000 units of penicillin, but organisms were not found until nearly 2 months had elapsed. In the case reported here, relapse was delayed approximately 2 months by the administration of 200,000 units of penicillin.

Although these cases are admittedly too few from which to draw valid conclusions, it appears that syphilitic relapse following 100,000 units or less of penicillin may be expected within 1 month after therapy, while 200,000 units may prolong the period before relapse by 2 months or more. As patients with gonorrheal complications and those in whom the first course of therapy was a failure often receive a total dose of 200,000 or more units of penicillin, prolonged observation is necessary to determine relapses at the earliest moment.

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HAIR OF WHITE RATS COLORED BY CHOLINE HYDROCHLORIDE

During the course of an experiment on rats in which choline hydrochloride was given, a bronzing of the hair was observed in a large percentage of the animals. This phenomenon was accordingly studied on 30 young male rats divided into 6 groups of 5 rats, each group fed on a slightly different diet, but all provided choline in their drinking water. Rats eating a high protein ration, a high sucrose ration, a high sucrose diet plus yeast or a high sucrose diet plus liver, bronzed. A protein diet enriched by either yeast or liver apparently protected all the young animals against the pronounced bronzing effect induced by choline. This coloration phenomenon was not observed in adult rats.—Higgins, G. M.; Joneson, O. R.; and Mann, F. C.: Bronzed pigmentation, on the hair of white rats, induced by choline hydrochloride. Proc. Staff Meet., Mayo Clin. 20: 320–323, September 5, 1945.

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AIDS IN DIAGNOSING DENTAL PULP DISEASES

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The dental pulp has no sense of touch or localization, and responds to stimulus only by sensation of pain, which may be produced by thermal, chemical, traumatic, or electric stimulation of the dentinal fibrils. Vitality implies only that the process of metabolism is continuing in the pulp. Degenerative changes may be going on at the same time. A few vital nerve fibers remaining in a pulp make it possible to elicit a response without accurately diagnosing the condition.

Of all the different types of tissue present, the nerve fibers are the most resistant to any change, whether inflammatory or degenerative. In view of this, definite pathosis may exist within the pulpal structures without completely destroying the nerve fibers (*1*).

The electric pulp tester, although necessary in some cases of difficult response, has certain disadvantages. Many times the apparatus is out of order or the operator is inexperienced in its use. A patient who has been shocked is prone to give false reactions for the remainder of an examination. Also, vital responses may be elicited from teeth with liquefactive necrosis of the pulp, pericementitis, and from multirooted teeth in which the pulp is necrotic in one root and contains vital fibers in the other. Devitalized teeth with metal fillings and those with metallic substances in the root canal may test vital. The fact that a tooth responds to an electric stimulus does not mean it has a normal pulp. It apparently denotes the presence of vital nerve fibers only (*2*).

When the pulp becomes purulent or dies, there is no response to cold, but heat gives pain. Heat will also test the vasomotor ability of the blood vessels. It is difficult, however, with gutta-percha, a hot burnisher, or warm water, to establish a constant temperature, and there is always the fear on the part of the patient that he will be burned.

Ice is a familiar substance that rarely causes discomfort and there is little apprehension on the part of the patient. Jack (*3*) made the observation that the earliest manifestation of irritation of the dental pulp is intolerance of cold temperatures, and that it is an invariable indication of excitation of the nerves of the pulp as the consequence of commencing hyperemia. This is significant because it would be in a measure possible to anticipate pulp involvement of the teeth of personnel who are to be on duty in areas remote from dental aid. Orban

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and Ritchey (*4*) have made the statement that the best diagnostic aid has been the response to stimulation with ice.

Ice is available at most Navy activities and may be used in any way that is convenient to apply it to the teeth. The following is a method in use at the Mayo Clinic. Special cone-shaped containers were designed in which to freeze water in a refrigerator. These containers are made of an aluminum blank turned down to proper size on a lathe. Each container is 3 inches high and 1⅛ inches wide at the base. The containers are held base-end up in a rack, which may be made in different sizes to fit the freezing compartment of any refrigerator. Ice frozen in one of these containers is easily removed by inverting the containers and holding it in a stream of tap water for a few seconds. The ice obtained has the shape of a cone, the base of which is large enough to be gripped firmly when held in a towel. The other end of the cone, being pointed, is easy to apply to any exposed surface of a tooth (*5*).

Cone-shaped containers may also be made of wax paper sealed with a hot spatula to make them watertight. Ice should be applied to the center of the largest area of sound enamel, on the buccal or labial surface, and held there until the patient indicates it is uncomfortable rather than painful. A control or "irritation point" should be established by determining the average or normal response from a similar anatomic tooth in the same mouth. Sometimes cold conduction waves, or water from melting ice, may elicit a response from a contiguous tooth containing a large restoration, or from the pericementum.

Ice has several advantages, one being that it requires no special tooth preparation, such as drying. It is a constant temperature on the melting surface, allowing a comparison to be made between a normal and abnormal tooth. It is possible to test the pulps of teeth containing large restorations and those bearing crowns.

In general the normal pulp will give an average response to stimulation with ice and the operator can be reasonably certain of its condition as the number of false positive responses are minimal. Coolidge (*6*) said that the changes in the pulp due to inflammation may be divided into the acute, chronic, and degenerative condition. Pulp hyperemia is characterized by marked sensitiveness to ice; this is of short duration and the severity of the pain indicates the degree of hyperemia. There is no reflex pain and the patient can usually locate the tooth. When pulpitis is in the early stages (acute suppurative pulpitis), it often is difficult to locate the offending tooth. When ice is placed on each tooth separately, the offending tooth is much more sensitive than the other teeth and the pain produced is prolonged, whereas when ice is applied to teeth in which the pulp is normal the pain produced rapidly disappears.

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When the pulp becomes putrescent, the continued application of ice to the affected tooth will afford relief from pain. In chronic ulcerative pulpitis there is little or no reaction to stimulation, due to the greatly lowered pulp function. A totally gangrenous pulp will give no response. The consensus of many investigators is that present testing methods are not infallible in degenerative changes, but of the methods in use, the thermal test is probably the most reliable.

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PREVENTION OF BED SORES

It is no longer permissible to regard pressure sores as "trophic" disturbances. Prevention is the best treatment. This demands constant vigilance to prevent continuing pressure by a hard bed, or by other parts of the body, upon soft tissues overlying bony prominences. Whenever possible a paralyzed patient should be placed upon an air mattress.

As a rule the patient may lie on his back on such a mattress indefinitely without developing pressure sores of the skin over the sacrum. Even with an air mattress, however, it is necessary to keep the heels off the mattress by placing a firm pillow or a folded blanket of sufficient thickness crosswise beneath the calves of the legs so that the heels do not touch the bed. Small pillows or cotton pads must also be placed between the knees and between the ankles and toes. Finally the bed covers must be kept off the toes by means of a frame.

If an air mattress is not available, air rings should be used to protect bony prominences. If these are not available, the surgeon must rely upon frequent turning of the patient and the use of cotton pads at vulnerable points.—SCARFF, J. E.: Surgical treatment of injuries of brain, spinal cord, and peripheral nerves. Surg., Gynec. & Obst. 81: 405–424, October 1945.

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MERCURIC CYANIDE IN TREATMENT OF PERIODONTAL DISEASE

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In the service it is imperative that the method of treatment of periodontal disease be quick and also simple. Under ordinary treatment a spirochetal infection is extremely resistant. Mercuric cyanide, a spirochete specific, was first introduced to the dental profession in 1920 by Corby [1] in the treatment of Vincent's infection. Since then it has been found most successful as an adjunct in the treatment of gingivitis, pericoronitis, and pyorrhea alveolaris when the infection is acute. This leads to the belief that the Bacillus fusiformis and Vincent's spirillum, to some extent, may be mutant forms of the same microorganism. It is known that Vincent's infection is associated frequently with local irritation and lack of oral hygiene.

Corby's experiments showed that the smallest oral dose of mercuric cyanide proving fatal to a guinea pig was 1 mg. per 100 gm., equivalent to about 75 cc. of a 1-percent solution for a 150-pound human being, while the prescribed amount introduced into a patient's mouth at any one time is 2 cc. of a 1-percent aqueous solution. The acidity of mercuric cyanide has been found to be 0.065 of 1 percent. Although the 1-percent solution produces a slight coagulation of albumin, it has been used by many in ophthalmology without deleterious effects. It apparently has no action on normal tissue, and unlike the escharotics and oxidizing agents, it is not irritating and does not destroy tissue. No action has been observed on metallic fillings, crown and bridgework, or dentures made of rubber or acrylic resins.

Conditions such as chemical irritation, and leukemia, pellagra, and debilitating diseases should be considered. It has been observed that in a syphilitic, treatment with mercury, arsenic, or bismuth may cause a necrosis of the oral tissues with extensive bleeding of the gums. In these cases the use of mercuric cyanide will not produce the desired results until antisyphilitic therapy is terminated. This may be due to immunity set up against spirocheticides, with added recurrent irritation after each syphilitic treatment.

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[1] Corby, A. E.: Mercuric cyanid in the treatment of Vincent's infection or so-called "trench mouth." Dental Cosmos 62: 612–619, May 1920.

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Abstinence from smoking and the use of alcoholic or carbonated beverages is recommended. A case apparently cured on Friday, with excessive smoking and drinking by the patient over the week end, may recur on the following Monday or Tuesday.

METHOD OF TREATMENT

Vincent's infection.—As the ulcerations are superficial, tender, hyperemic patches covered by a grayish membrane, it is best to cleanse them by spraying, or by wiping with a cotton swab. Even the slightest surgical procedures should be avoided at first.

The patient is emphatically instructed not to swallow any of the solution to be used. The armamentarium is made up of a 2-cc. Luer syringe, to which is attached a dull, flexible iridoplatinum needle which is used carefully to flush the 1-percent solution around the gingival trough buccally, labially, and lingually. A drop may be deposited into any existing pockets, taking care *never to force the solution.* It is therefore important that the tracing or flushing be done very slowly. The solution is flushed around the upper teeth first and the patient is requested to expectorate; the procedure is continued around the lower teeth and the patient expectorates again. In fact, because of an increase of salivation during this treatment, he should be allowed to empty his mouth at any time and will ask to do so often.

Following this procedure, 2 cc. of the solution has been found ample to flow around and into all parts of the mouth, even to covering the lips in expectorating. If the lesions or ulcerations are extensive, a cotton swab saturated with the solution may be applied gently to the lesions, taking care that it covers the entire area of infection. Immediately after this operation, the patient rinses his mouth thoroughly with a mild mouthwash or plain water. For the average case, one treatment daily has been found sufficient.

Prophylactic treatment should be instituted on the second or third day, depending upon the severity of the case. In severe cases, if it is convenient, this procedure can be followed twice a day for the first day or two and then once a day. Improvement is evidenced clinically by the fact that brushing the teeth, which was an impossibility prior to treatment, can be performed easily, regularly, and without pain. These procedures should be continued daily until all evidences of active infective processes have disappeared, and the tone and circulation of the gingival tissues have returned to normal. Partially erupted or impacted third molars and diseased tonsils are favorite breeding grounds; these frequently must be removed for the permanent control of the infection.

Pyorrhea and gingivitis.—This condition is one of the most difficult problems in dental pathology. Pyorrhea cannot exist without pyo-

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genic bacteria. Without bacteria no pus can be found. One might question the importance of the statement so often made, that periodontoclasia can exist only as the result of the presence of the streptococcus and staphylococcus. The future may show that the spirochete plays a much greater role in this disease than it is given credit for at the present time.

When the gingival tissues are disturbed, either by local irritation or by systemic fault, gingivitis develops and the gingival tissues lose their tone and become detached from the necks of the teeth. In this manner the gingival trough is opened and an opportunity is offered for the entrance and growth of oral microorganisms. If these gingival tissues could be kept in health and in normal relationship to the teeth which they surround, pyorrhea would not occur.

In the treatment of this condition, mercuric cyanide in 1-percent solution is traced around the gingival troughs of the teeth, as described previously. The gingival tissues recover their normal pink hue and their original tone and firmness.

In a pyorrheal condition, the soft tissue is involved, and the presence of Vincent's organisms can always be demonstrated. They are deep-seated and can be destroyed by treating as in a chronic case of Vincent's infection. The platinum needle is bent to the desired shape so that the solution may be carried to the very seat of the pyorrhea lesions. The light, small syringe is most adaptable in feeling one's way to the base of a pocket. The use of the solution should follow the operative procedures usually employed in the treatment of pyorrhea, thereby flushing to the surface most of the residual pus and loosened debris. In pockets with a fistula, the path of the fistula is followed and lightly and slowly irrigated from the gingiva to the opening. Three or four treatments will usually suffice to dry up the fistula.

Of course, when Vincent's infection is associated with pyorrhea, complete eradication of the specific organism is accomplished with concurrent treatment and obliteration of the pyorrhetic lesions.

Pericoronitis.—This condition is usually associated with tissue overlying the lower third molar in cases of delayed or faulty eruption. Again we are dealing with the same type of microorganisms. The disease is most resistant to ordinary forms of treatment. Some prefer to excise this flap to reach the seat of the infection, but in my opinion this procedure is dangerous.

The platinum needle is bent to the desired shape to slip under the tissue, thereby reaching around or over the top of the crown of the tooth to the seat of the infection, and the solution is flushed in lightly and slowly. In severe cases this may cause considerable pain, which can be relieved by cold application. This is repeated daily, and when all soreness has disappeared, surgical procedures may be undertaken.

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SUMMARY

In the treatment of periodontal disease with mercuric cyanide over a period of 8 months, averaging approximately 1,000 treatments a month, no patient with Vincent's stomatitis had to be admitted to the sickbay. The temperature became normal and general malaise was relieved in a short time after the first application. Gratifying results were obtained in cases in which prophylaxis could not be carried out.

Highly encouraging results were obtained in treating pyorrhea cases in conjunction with general treatment and local interventions necessitated by the state of the gums and of the alveolar process. Improvement in the general condition was evident in every case. Surgical removal of lower third molars, after mercuric cyanide treatment for pericoronitis, was highly successful.

If the procedure as outlined is followed and the simple precautions are taken, no fear should be felt as to the toxicity of a 1-percent aqueous solution of mercuric cyanide. As an added precaution, milk or malted milk tablets may be given after each treatment as an antidote.

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CLINICAL NOTES

EXOSTOSIS OF SACRUM

REPORT OF A CASE

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Osteomas are uncommon and when they do occur they are usually found on the long bones at the end of a diaphysis, close to the epiphyseal line. There are two types, the compact osteoma, occurring as a hard, sessile tumor as may be seen in the vault of the skull, and the cancellous type, seen as a pedunculated overgrowth covered by a cap of cartilage. Although malignant changes rarely if ever occur in osteomas, local recurrence does result if the cartilage cap is not removed in its entirety.

Osteochondromas, on the other hand, are periarticular, related to the end of the long bones and to precartilaginous connective tissue. Although Geschickter and Copeland, in a series of 250 cases, noted no osteochondroma of the sacrum, the epiphyseal changes during development of the sacrum between the ages of 18 and 25 are, according to Cunningham, quite compatible with the development of such tumors. Enormous cartilaginous masses have been seen projecting from the sacro-iliac synchondrosis, and endochondral ossification of such a mass to an osteochondroma, leaving a cap of cartilage, may well occur. The symptomatology with these benign tumors is confined to pressure or inflammatory changes; however in 7 percent of the cases sarcoma develops. In 5 percent of all cases of osteochondroma the tumor recurs after removal. In those incompletely removed, recurrence is probably close to 100 percent.

Case report.—A 21-year-old servicewoman was discharged from the Army in July 1943, following hospitalization and discovery of a tumor mass originating from the sacrum.

In April 1943 the patient had awakened one morning with severe pain at the base of her spine and a drawing sensation down the back of her legs. She was

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immediately hospitalized and while in the hospital suffered from an intermittent dull pain at the base of her spine, intermittent numbness at the back of her legs, frequency of urination, and constipation, hitherto not present, requiring frequent laxatives to produce bowel action. X-ray examination at the time revealed the presence of a tumor attached to the anterior surface of the sacrum. Upon being discharged from the Army in July 1943, she was admitted to a Veterans' hospital and was discharged from that in October 1943.

She was admitted to the U. S. Naval Hospital, San Diego, in July 1944, 1 year after her discharge from the Army, complaining of pain at the base of her spine, and a drawing sensation in the back of her legs. From the time of her discharge from the Veterans' hospital, the patient had worked at various jobs, including that of salesgirl and waitress, but gradually her symptoms increased in severity, and at the time of admission to this hospital, pain and tenderness were almost continuously present at the base of her spine; numbness, burning, and weakness were present in both legs, and the left leg dragged noticeably. She complained of nocturia of three or four times a night, nonproductive urgency, and occasional incontinence. Defecation was accomplished only with the aid of enemas. She also complained of fatigue and discomfort when she was on her feet.

The family history was negative for tumors. The past medical history revealed that she had suffered a fall from a horse at the age of 10, with no knowledge of injury incurred at the time. In December of 1942 the patient was subjected to a caesarean section of a 5-months' pregnancy but did not know the reason for the operation.

An inventory of systems did not add any substantial information. The patient was nervous, apprehensive, thin, and poorly nourished. Pelvic and rectal examination revealed a large, hard, fixed mass on the anterior surface of the sacrum. Neurologic examination disclosed anesthesia to pinprick in the fifth, fourth, and perhaps the third sacral segments on the right side, with no change on the left. Both ankle jerks were absent. Knee jerks were present. The right labium majus and minus, and the right half of the introitus were anesthetic.

Stereoscopic examination of the pelvis showed an irregular bony mass, extending anteriorly from the midportion of the sacrum, measuring 8 cm. in diameter, and attached to the sacrum by a pedicle 3 cm. in diameter. The other bones of the pelvis appeared normal.

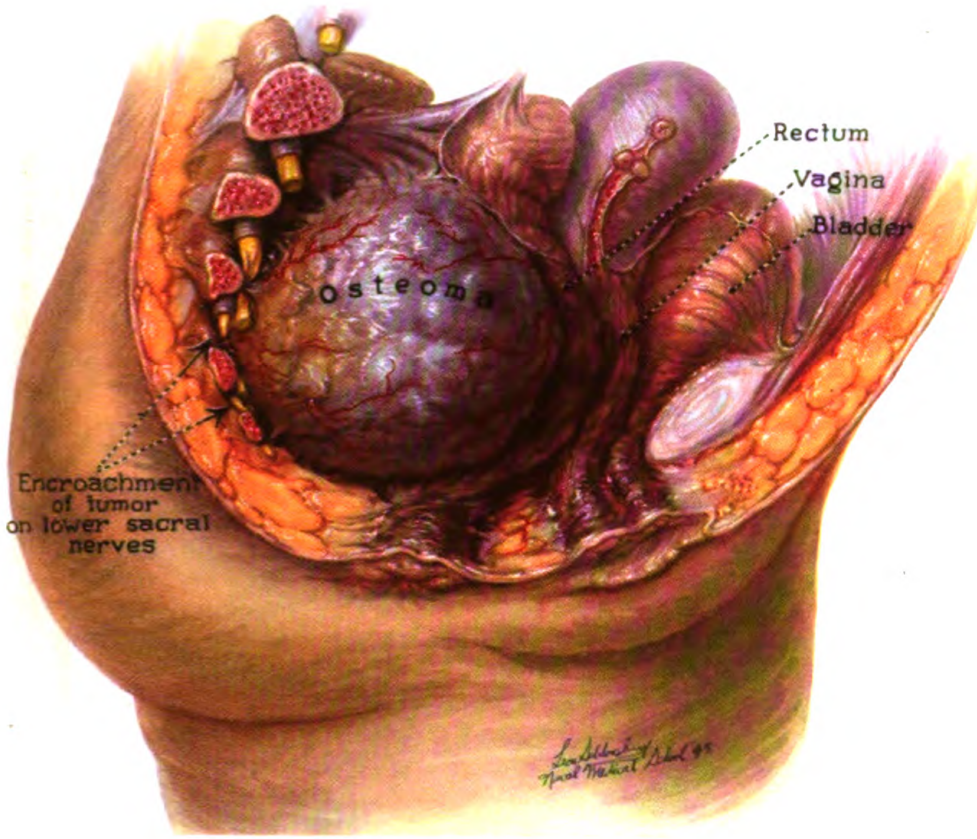
Fluoroscopic and radiographic examination of the large bowel showed the distal portion of the rectum to be displaced anteriorly and to the left by the large mass previously described, projecting anteriorly from the midportion of the sacrum. There were no abnormalities of the bowel.

X-ray examination of the chest and the urinary system, including intravenous pyelogram, yielded negative findings. Laboratory studies were within normal limits except for a few white blood cells in each specimen of urine.

The clinical diagnosis was osteoma or osteochrondoma of the anterior surface of the sacrum, involving the lower three sacral roots on the right.

The patient was observed for 1 month and then re-examined. Her general condition was somewhat improved; however her specific symptoms were slightly more severe, with an increased limp of the left leg and a definite increase in the severity of the pain and tenderness of the back. On several occasions the patient had to be catheterized because of inability to void. Evacuation of the bowels was accomplished only with enemas. Occasional swelling of the ankles was noted. Neurologic examinations revealed, in addition to the previous findings, involvement of the third and second sacral segments on the left side

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Sagittal section of pelvis, showing position and anatomic relationship of osteoma of the sacrum.

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and absence of the left knee jerk. From these changes it was concluded that the mass had increased in size, and further increase in symptoms was inevitable without surgical intervention.

On 10 August, using spinal anesthesia, operation was performed. Through a midline suprapubic incision the abdomen was entered, and the sacrum was exposed by incision of the overlying peritoneum and deflection of the mesentery of the sigmoid toward the left. A large tumor was found, arising from the body of the sacrum and projecting into the pelvis to such extent as to displace the rectum, the uterus, and the bladder anteriorly and to interfere with normal function of these organs. From the character of the growth it was judged that this was an osteoma of a benign nature rather than an osteochondroma. The tumor was removed in its entirety down to the surface of the sacrum. Upon attempting to clear the sacral foramina of encroaching bony tissue, profuse bleeding was encountered, possibly from the midsacral or hypogastric vein, and it was necessary to pack with a large abdominal pad, leaving it in place.

The viscera were protected by a rubber dam. The wound was then closed from its upper extremity to the lower third with interrupted steel wire. The lower third was left unsutured in order to permit the removal of the packing. The patient received infusions of 2,000 cc. of whole blood and 1,000 cc. of 5-percent dextrose and saline while on the operating table.

The specimen consisted of bone fragments, mostly of spongy bone covered by a thin layer of cartilage. Microscopic examination of sections revealed cancellous bone, which was interpreted as comprising an exostosis with no evidence of malignancy.

The postoperative course was very slightly, if at all, complicated by the presence of the large hemostatic pack. This pack was removed 4 days after surgery, using pentothal anesthesia, without recurrence of the hemorrhage. The patient received a prophylactic course of 10,000 units of penicillin every 3 hours for 14 days. Because of persistent inability to void, it was necessary to catheterize her daily for 20 days during which time she developed a cystitis which was controlled by a course of penicillin (a total of 240,000 units) and subsequently by small daily amounts of sulfadiazine. On the twenty-fourth day after surgery, the patient was able to void, with only a small amount of residual urine. She was permitted to be up in a wheelchair and shortly thereafter was fully ambulatory.

Two months after surgery, the patient was re-examined Her only complaint at that time was of constipation All urinary symptoms had disappeared, as had the limp and the backache Neurologic examination disclosed that the former areas of anesthesia in the fourth and fifth sacral segments on the right side were now hyperesthetic, all foot movements were well performed, and knee jerks were present, although ankle jerks were still absent. Pelvic and rectal examination failed to reveal a tumor mass.

Roentgenologic re-examination of the sacrum showed complete removal of the tumor mass. There was still some irregularity in the outline and density of the midsacral segment, indicating that the tumor had apparently invaded or had originated in these sacral bodies. The patient was discharged from the hospital following this examination.

SUMMARY

1. A case of osteoma or osteochondroma arising from the sacrum is reported.

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2. Progressive and incapacitating neurologic, urinary, back, and bowel symptoms have been almost completely relieved by resection of the tumor mass.

3. Whether or not this tumor will, after a period of years, recur and require a second resection poses an interesting question.

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HEART AND BRAIN EXTRACTS CONTROL INFECTION

A factor has been extracted from ox brain, spleen, heart, and kidney tissue, which in vitro is capable of converting yellow X forms of Staphylococcus aureus to white R, the latter having biochemic characteristics quite different from the former. Moreover this organism retains its altered morphologic and biochemic characteristics in vivo and is definitely less virulent than the yellow S form. Prophylactic and therapeutic tests with the brain extract show that it is effective in preventing and treating Staph. aureus infections, the efficacy of the treatment probably resulting from a decrease in virulence of the organism produced as a result of alteration in its morphologic and biochemic characteristics.—NUTINI, L. G., and LYNCH, E. M.: Effect of tissue extracts in controlling Staphylococcus aureus infections. Nature 156: 419–420, October 6, 1945.

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SELECTION OF PATIENTS FOR BLOOD TRANSFUSION

In the immediate treatment of battle casualties transfusion therapy tends to be abused. Oligemia is the sine qua non. At divisional level transfusion must be tempered with sound judgment. If the blood pressure is moderately high and the pulse satisfactory, the patient should be evacuated quickly, no matter what injuries are present, and he will probably travel safely. If there is any doubt about his condition, a traveling transfusion is a wise precaution. Transfusion will seldom be required for chest and abdominal injuries, because in the former it is dangerous and in the latter it is usually unnecessary. Long-continued resuscitation of poorly responding limb cases should not be undertaken, and these patients should be evacuated as quickly as possible, with a traveling transfusion, to a surgical center. At corps level the most important factor in deciding whether or not to transfuse is the nature and severity of the wounds.—CONWAY, H.: Selection of patients for blood transfusion. Lancet 2: 206–208, August 18, 1945.

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MENINGOCOCCEMIA WITH WATERHOUSE-FRIDERICHSEN SYNDROME

REPORT OF CASE TREATED WITH PENICILLIN

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Meningococcemia with suspected adrenal hemorrhage has responded to treatment with the newer chemotherapeutic drugs. The following case is reported because of the rapid response to penicillin therapy. Martland (*1*) reported 19 autopsies in fatal cases of adrenal hemorrhage. He called attention to the failure of the sulfonamides in this disease and recommended a trial of penicillin. Thomas (*2*) found adrenal hemorrhage of some degree in 20 of 49 patients dying of cerebrospinal fever. He recommended that antitoxin be administered along with the sulfonamides, as it was his opinion that the adrenal hemorrhage was due to toxemia. Gross-Heisler and Davis (*3*) had 7 cases of purulent meningitis that were refractory to the sulfonamides. Whitaker (*4*) reported 2 of 4 patients with adrenal hemorrhage who recovered following sulfonamide therapy. Rosenberg and Arling (*5*) noted good results with penicillin in the treatment of meningococcus infections. Dawson, Hobby, Meyer, and Chaffee (*6*) proved the effectiveness of penicillin in meningococcus infections in mice.

Case report.—A 17-year-old sailor was admitted to the hospital at 1100 on 30 December 1944 in a stuporous condition. The temperature was 103° F., pulse rate 120, and blood pressure 110/70. The night before he had attended a show and later had slept poorly. He stated that he knew he was quite ill during the night but was able to walk, with help, to morning sick call. He became drowsy and was transferred to the main dispensary at 0915 and to the hospital at 1100. Another patient who was admitted to the ward at the same time and who appeared more acutely ill, was attended to first, and upon returning to this patient, a decided change was noted. He had become stuporous and somewhat cyanotic. The pulse and blood pressure remained the same. Nuchal resistance, and positive Kernig and Brudzinski signs were present. Petechiae were present over the entire body and one was seen on the right sclera.

The spinal fluid cell count revealed 8 leukocytes per cubic millimeter, and gram-negative intracellular diplococci. The spinal fluid sugar was 51 mg. percent, the protein 81 mg. percent, and the Pandy test was positive.

Immediate treatment consisted of 20,000 units of penicillin intrathecally, 40,000 units of penicillin intramuscularly, and 5 gm. of sodium sulfadiazine in 1,000 cc. of lactate-Ringer's solution intravenously. This was followed by 15,000 units of penicillin intramuscularly every 3 hours.

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By 1400 the patient was more stuporous and cyanotic. At 1600 infusions of 5-percent dextrose in normal saline solution were started. At 1700 the blood pressure was 100/60, the pulse was slower, and the patient's color was improved. At 1830 the blood pressure varied from 84/60 to 94/60, but the pulse was slower and cyanosis was less marked. Ten cubic centimeters of an adrenal cortex extract was added to the infusion and this was repeated at 3-hour intervals for 3 doses. After the first dose the blood pressure began to rise slowly and the next day it remained around 100/60; the pulse rate was 72, and the petechiae disappeared rapidly.

Convalescence was uneventful. The total dosage of penicillin was 990,000 units intramuscularly and 20,000 units intrathecally.

COMMENT

This case is reported to emphasize again the rapid course of meningococcemia and the apparent specific action of penicillin on the meningococcus. It may be that, at least in the early stages of this disease, the hemorrhage into the adrenal gland will cease when the meningococcus is rendered inert by the antibacterial action of this drug. Dextrose, sodium chloride, fluids, and adrenal cortex extract are invaluable adjuncts to therapy.

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NO SEQUELAE IN FILARIASIS

After several months' observation of several hundreds of cases, it now seems that the problem of filariasis is not a serious one and that the vast majority of persons now infected will shortly experience their final difficulty. In the interim between inception of symptoms and recovery, the most important procedure is the prevention of "hospitalitis" by a sane and interesting program of mental and physical activity.—COGGESHALL, L. T.: Malaria and filariasis in returning servicemen. Am. J. Trop. Med. 25: 177–184, May 1945.

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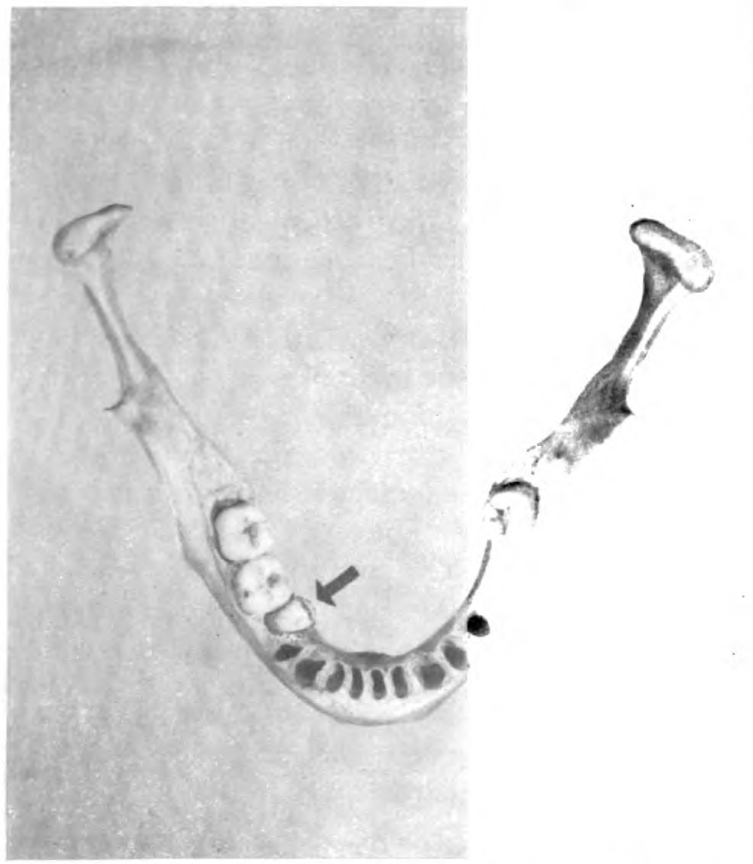
IMPORTANCE OF ACCURACY IN RECORDING OF FIRST DENTAL EXAMINATION

REPORT OF UNUSUAL CASE OF IDENTIFICATION

FRANCIS G. ULEN
Captain (DC) U. S. N.

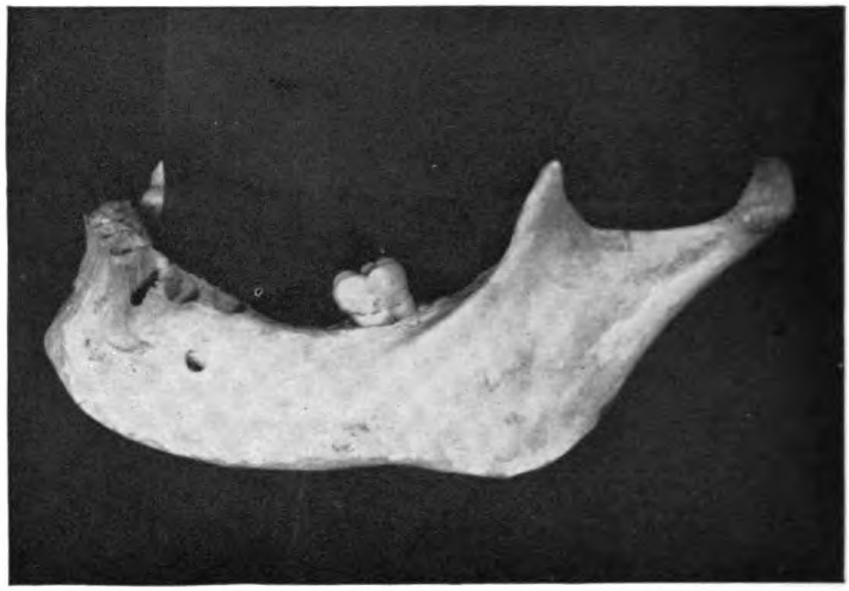
The importance of preparing the record of a first dental examination with fullness and accuracy is illustrated by the following unusual case in which proof of death and positive identification of the dead man were made possible as a result of the careful preparation of the dental record. This was accomplished despite the fact that only the mandible of the man was recovered and this contained but four teeth.

The vessel on which the casualty occurred suffered battle damage sufficiently close ashore to have made escape to the beach possible.



1. The lower right second bicuspid was in marked linguoversion.

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2. The resorption of the alveolar process and migration of the third molar indicate an early loss of the left first and second molars.

One crew member, known to have been in the vicinity of the damaged area at the time of the explosion, was unaccounted for. As no positive evidence of death existed, he was listed as missing in action. The damaged compartments of the ship were open to the sea until temporary repairs were made approximately 4 months later. During a part of this time the bodies of both allied and enemy casualties were known to have been in the water. One of these might easily have been washed aboard.

At the time temporary repairs were effected, search was made for evidence of the missing man but with no results. Later in the course of drydock repairs a human mandible was found in the damaged area of the vessel. This mandible contained only the right second bicuspid, right first and second molars, and left third molar. The alveolar sockets of the right first bicuspid, six anterior teeth, and the left bicuspids were empty. The lower right first molar contained a small occlusal amalgam restoration and a small external (buccal pit) amalgam filling. The second molar contained a small occlusal amalgam filling.

These amalgam restorations, being located in areas where caries is very frequent, were considered insufficient to establish identity. However in comparing the chart of the mandible with the record of the first dental examination of the missing man, it was noted that the record indicated not only the size and location of dental restorations, and the fact that the lower left first and second molars and right third molar were missing at the time he entered the service, but also quite

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properly included a note to the effect that the lower right second bicuspid was in extreme linguoversion.

Re-examination of the mandible was requested, and disclosed the fact that the right second bicuspid was in linguoversion and that marked resorption of alveolar processes had occurred in the edentulous area of the lower left molar region. This additional data, together with the size and positions of the amalgam restorations, made possible the proof of death of the crew member previously reported missing in action.



EPIDEMIC HEPATITIS

A comparison of the clinical observations on patients with epidemic hepatitis with those of patients with postvaccinal hepatitis reveals several differences worthy of mention. Of the patients with postvaccinal hepatitis, as reported by Turner and his coworkers, only an occasional one had fever, whereas fever, chills and evidence of an infectious process were outstanding features in 61 percent of the patients in this group. The incidence of various types of dermatitis in the patients with postvaccinal type of hepatitis was much more frequent than in those with epidemic hepatitis. Only 2 percent of our patients exhibited any type of dermatitis, in contrast to the high incidence of dermatitis in the postvaccinal group. Lymphadenopathy, frequently pronounced in this series, is not mentioned in the reports on cases of postvaccinal hepatitis. There seemed to be a more frequent tendency for anemia and severe complications to develop in the latter group. Psychic reactions were not observed in any of our patients. It is noteworthy that even in the rapidly fatal case in this series the patient's mental reaction remained clear until he died.

When epidemic hepatitis is compared with catarrhal jaundice, it is apparent that the observations are quite similar. We do not feel that we can distinguish any significant differences between acute infectious (epidemic) hepatitis and catarrhal jaundice. The term "acute infectious" (or "epidemic") hepatitis seems to be preferable to the term "catarrhal jaundice" for describing this disease. The latter term is misleading, as there is definite evidence of hepatic parenchymal and hepatocellular involvement, and as hepatitis without jaundice is relatively common. There is no doubt in our minds that this is frequently a serious disease, which by its seemingly benign course may mislead both the patient and the clinician. A prolonged convalescent period is required before hepatic functional efficiency is restored to normal and the patient is to be considered well.—FINKS, R. M., and BLUMBERG, R. W.: Epidemic hepatitis with and without jaundice; some clinical studies on 255 patients among troops in a combat zone. Arch. Int Med. 76: 102–113, August 1945.

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EFFECT OF FORMALDEHYDE ON GRAMICIDIN

The treatment of tyrothricin with formaldehyde resulted in a loss of 80 to 90 percent of the original hemolytic activity and a loss of up to 50 percent of the antibiotic activity. The action of formaldehyde on gramicidin gave a similarly reduced hemolytic effect but the antibiotic activity, estimated with Staphylococcus aureus, was found to be unchanged. Preliminary tests with rats (intraperitoneal injections) indicated that the modified gramicidin was considerably less toxic than untreated gramicidin.—LEWIS, J. C.; DIMICK, K. P.; FEUSTEL, I. C.; FEVOLD, H. L.; OLCOTT, H. S.; and FRAENKEL-CONRAT, H.: Modification of gramicidin through reaction with formaldehyde. Science 102: 274–275, September 14, 1945.

PENICILLIN WITH ALUMINUM HYDROXIDE

A convenient, practical and effective procedure of administering penicillin by mouth consists of mixing the drug with one tablespoonful of aluminum hydroxide. Substantially higher blood levels are obtained following a 50,000- and a 100,000-unit dose of penicillin with this method than after administration of the drug dissolved in water, either with or without previous ingestion of a mild antacid, such as aluminum hydroxide. Absorption of penicillin on aluminum hydroxide appears to exert a local protective effect against that portion of gastric acid with which it comes into contact.—BARACH, A. L.; GARTHWAITE, B.; OPPENHEIMER, E. T.; FORMAN, J.; and OSBURG, H.: Oral administration of penicillin. Science 102: 247–250, September 7, 1945.

BLOOD PRESSURE IN PREGNANCY

In a study of 300 cases of normal pregnancy followed through three trimesters at the University of Michigan Hospital it was found that systolic blood pressure does not vary significantly during any period of gestation, nor does it deviate from what might be considered normal systolic blood pressure for healthy nonpregnant women.

There is evidence, however, that diastolic blood pressure tends to be slightly lower in the first and second trimesters of normal pregnancy than in the normal nongravid state. Any persistent, even though slight, increase in either systolic or diastolic pressure during pregnancy should therefore be looked upon as potentially significant.—ANDROS, G. J.: Blood pressure in normal pregnancy. Am. J. Obst. & Gynec. 50: 300–306, September 1945.

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ALLERGY TO PENICILLIN CALCIUM TOPICALLY IN BLEPHAROCONJUNCTIVITIS

KARL B. BENKWITH
Lieutenant Commander (MC) U. S. N. R.

The increasing tendency of ophthalmologists to employ penicillin locally in the form of the more stable salts, calcium, and barium, either as a corneal bath or in ointments, suggested the report of a case of severe allergy of the eyelids and adjacent skin of the face which was directly attributable to the topical use of penicillin calcium solution.

Case report.—A Naval officer reported to the sickbay with an acute, monocular, purulent blepharoconjunctivitis. The history disclosed that the condition had been in an arrested stage with a low-grade reddening of the lid margins for many weeks. Previously there had been acute exacerbations. Overnight the lids of the right eye became heavy and a purulent discharge which matted the lashes together appeared.

Examination of the eyes disclosed a diffuse purulent palpebral conjunctivitis with an associated though less marked bulbar lesion. The lower conjunctival cul-de-sac contained thick threads of pus. There was no papillary hyperplasia, and there were no foreign bodies. The conjunctiva was hyperemic but not definitely edematous. The cornea was clear. The margins of the lids in the region of the ciliary glands showed many pinhead-size abscesses, some having ruptured, leaving abraded areas. Smears and culture identified a coagulase-positive Staphylococcus aureus as the causative organism.

The eye was treated first with hot boric acid packs which encouraged the rupture of the small abscesses at the lid margins and cleared the purulent discharge. Immediately following this, instillation of 6 drops of penicillin calcium solution into the lower conjunctival cul-de-sac was done hourly from 0600 to 2200 for 2 days. The lids were closed, with some penicillin solution exuding over onto the lid margins about the base of the lashes.

After 48 hours the purulent discharge had ceased and there was no longer evidence of a blepharitis. Simultaneously, however, the skin of the lids, nose, and malar regions on the side of the treated eye became red, elevated, itched, burned, and in places showed weeping of a serum-like fluid. Subsequently, in rapid order the lids swelled, became heavy, and displayed a typical allergic dermatitis. No chemosis of the conjunctivae was ever present.

Skin tests were immediately performed, using calcium penicillin solution similar to that which had been dropped into the eye previously. A small 0.1-cc. intracutaneous injection was made on one arm. In 24 hours an urticarial reaction measuring 5 cm. in diameter and showing elevation was present. This area was the site of extreme itching and burning. A patch test, moreover, using an ointment, produced an equally severe allergic reaction on the patient's arm. A control injection on the author's arm produced no reaction.

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With cessation of penicillin therapy, and on treatment of the allergic reaction, the conjunctivitis, blepharitis, and the allergic phenomena completely disappeared, the eye returning to normal.

COMMENT

No staphylococcus toxoid was available to make sensitivity skin tests on this patient. The allergic phenomena were totally unexpected and proved a problem during the course of treatment. Two separate batches of commercial penicillin preparations made by different manufacturers were tested, and the patient was found equally allergic to both. Distilled water used in the solution of penicillin gave no allergic reaction when injected into the patient's forearm. Likewise lanolin used in the ointment excited no allergic reaction when patch tested on the patient's forearm.

This case is reported primarily because of the allergic response to the topical application of penicillin salts when used in the treatment of eye infection.

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NEED OF CALCIUM, PHOSPHORUS AND VITAMIN D IN HYPERTHYROIDISM

Adequate calcium, phosphorus, and vitamin D should especially be administered to all hyperthyroid patients who for some reason do not come to surgery early. The patients included are those who refuse operation, inoperable cases, and those who are being treated by thiouracil, by older medical methods, by x-ray therapy, or by a combination of these methods of therapy.—PUPPEL, D.; GROSS, H. R.; MCCORMICK, E. K.; and HERDLE, E.: Rationale of calcium, phosphorus, and vitamin D therapy in clinical hyperthyroidism. Surg., Gynec. & Obst. 81: 243–265, September 1945.

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DOUBLE DOSES OF SULFADIAZINE IN PNEUMONIA

A study of two large groups of patients with pneumococcic pneumonia of comparable severity, treated similarly in every respect except that one group received double doses of sulfadiazine, demonstrated that the use of higher doses of sulfadiazine resulted in a great decrease in mortality rate and a decrease in length of stay in the hospital, without any notable change in incidence of drug toxicity.—COLLEN, M. F., and PHILLIPS, E.: Optimum dose of sulfadiazine in treatment of pneumococcic pneumonia. Arch. Int. Med. 76: 22–30, July 1945.

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MULTIPLE INFECTION WITH INTESTINAL PARASITES ON A NAVAL VESSEL

JOHN R. HERMAN
Lieutenant Commander (MC) U. S. N. R.

Cases of multiple infection with intestinal parasites, while not infrequent in many tropical areas, were rarely seen in large numbers on board Naval vessels. However with the rapid advances made against Japan and the many new territories invaded, this problem assumed increasing importance.

Soon after the recapture of one of our central Pacific islands, a program was started to enlist the natives (Chamorros) in the Navy as steward's mates. These men were sent almost immediately to the SOPA ship for minimal training in the duties of a steward's mate and for distribution to fleet units. No prophylactic immunizations, Kahn tests, blood groupings, or stool examinations were done ashore.

All the Chamorros appeared in good health, and distribution to small craft and ships was commenced almost at once. This was halted, temporarily, when it was found that all of these men were carriers of intestinal parasites. The parasite infection was forcibly brought to attention by a case of acute ascariasis and probable ascaris pneumonia.

Case report.—A 17-year-old Chamorro steward's mate, who had just enlisted in the Navy, returned from a 24-hour liberty complaining of severe pain in the left lower part of the chest. This pain was sharp on inspiration but was present all the time. He was obviously ill and was at once brought to this vessel for examination.

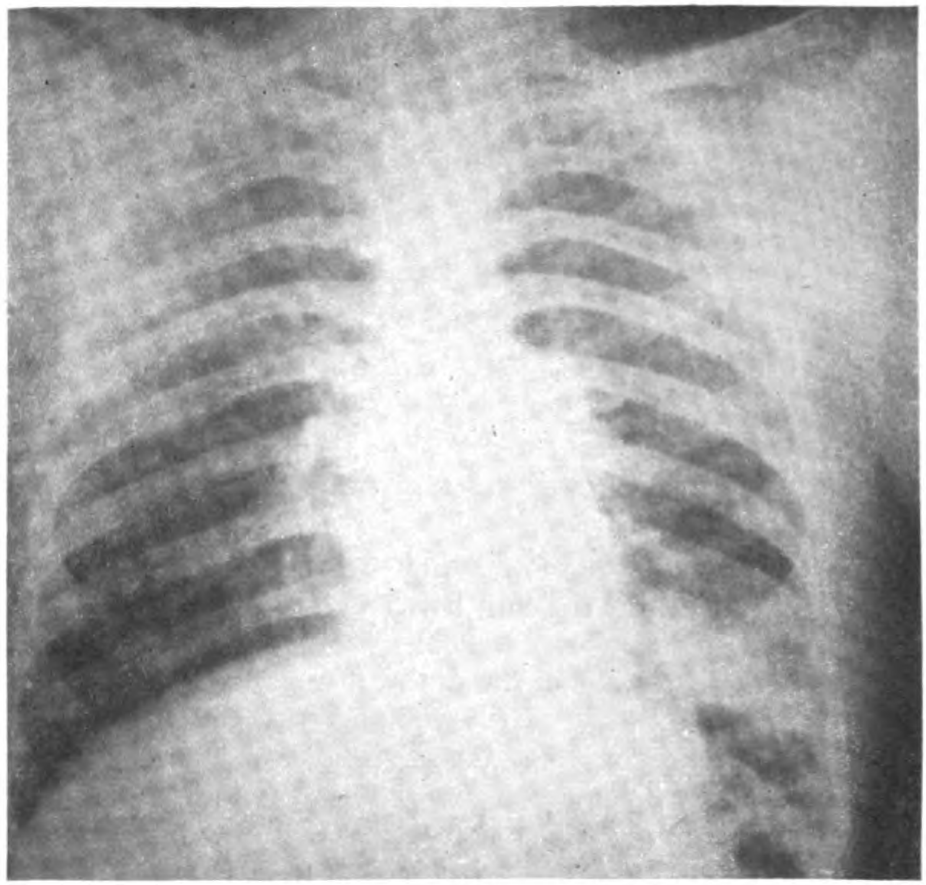
The temperature was 103.8° F., pulse rate 130, and respirations were 28 per minute. The patient's eyes were dull, the skin hot and dry, and he was evidently in considerable pain. He had a hard, nonproductive cough and tended to splint his left chest. There were definite signs of a patchy consolidation near the base of the left lung at the midaxillary line.

The erythrocytes numbered 4,200,000 per cubic millimeter of blood and the leukocytes 30,000, with 12 percent band forms, 79 percent segmented cells and 9 percent lymphocytes. The urine had a specific gravity of 1.020, a pH of 5.5, no sugar, and a faint trace of albumin; it was microscopically negative. Chest x-ray findings are shown in figure 1.

The patient was given 100,000 Oxford units of penicillin with no obvious immediate benefit. Pain was relieved 36 hours later, however, and the temperature was normal in 48 hours.

Six days after admission the patient's condition was excellent. He no longer had the hard cough or pain, and on that day the leukocyte count was 16,500 with 66 percent segmented cells, 13 percent lymphocytes, 2 percent monocytes, and 19

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1. Chest roentgenograph of probable case of ascaris pneumonia.

percent eosinophils. This was the first appearance of eosinophils in the smear, and stool examination was done at once. The stool was found to be loaded with ova of Ascaris lumbricoides. Trichuris trichiura and hookworm ova were also found in considerable quantity (fig. 2).

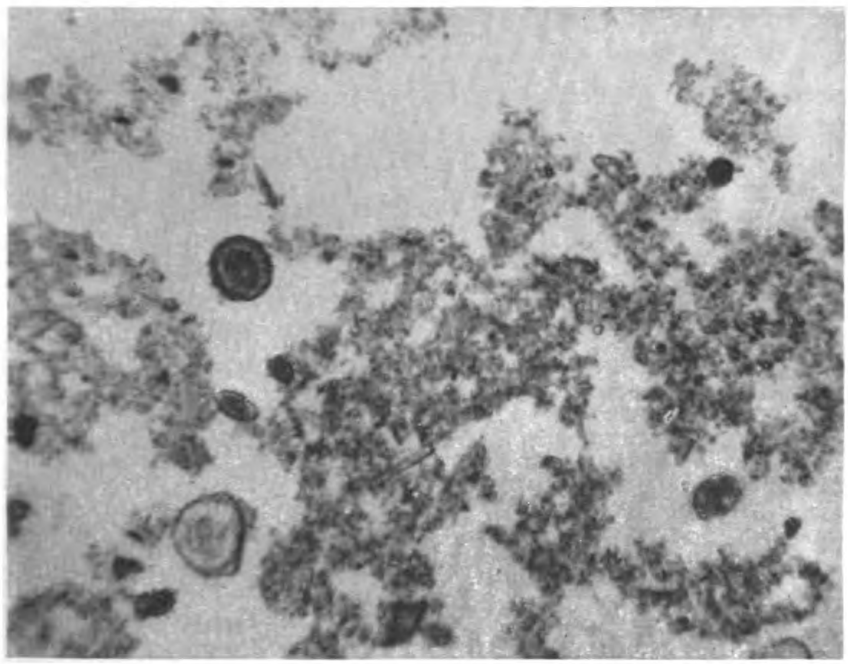
The patient was given hexylresorcinol crystoids, 1 gm. by mouth, and a magnesium sulfate purge in 24 hours. Several ascarides were found in the first stool but there were still fertile ascaris ova in large numbers in the feces. A second and third treatment over a 2-week period were needed before all the ascarides were eliminated, as demonstrated by repeated negative stool specimens.

Three weeks after admission the leukocyte count was 13,700 with 24 percent eosinophils. There were still threadworms (trichuris) in the feces but no hookworms, and it was considered safe to send the patient back to duty with, however, frequent follow-up examinations in the next several months. The hookworm in this case was identified as Ancylostoma duodenale.

It is of interest that this patient, when questioned further, told of having had "worm medicine" before the war and of not being able to get any during the Japanese occupation.

Without finding ascaris larvae in the sputum, no positive diagnosis can be made in this case, but the atypical pneumonia, and the sudden appearance of eosinophils in large percentage, point to the probable diagnosis of ascaris pneumonia.

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2. Photomicrograph of saline suspension of stool, showing ova of ascaris, hookworm, and trichuris.

After finding specimens of ascaris, trichuris, and hookworm in the stool of one Chamorro, it was decided to examine the feces of all the native enlistees as a protective measure. Direct saline smears were done on all original stool examinations. After treatment, several specimens were examined by de Riva's concentration method, and several slides of direct saline smears were examined to check on the results of therapy. On the average five stool specimens were examined for each man given complete therapy.

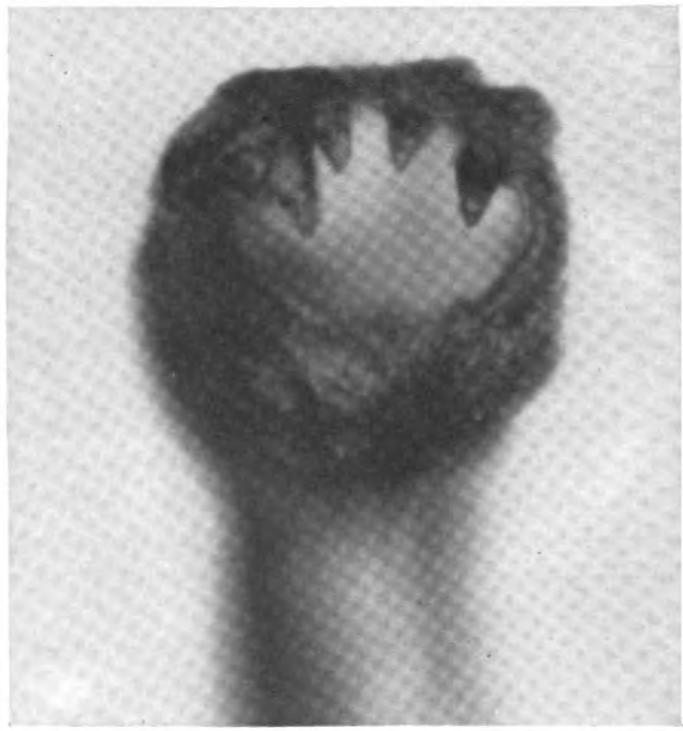
The feces of 50 Chamorros were examined and all were found to be infected with one or more types of parasites as follows:

Total patients	50
Hookworm, Ascaris, Trichuris	23
Hookworm, Ascaris	10
Hookworm, Trichuris	3
Hookworm	9
Ascaris, Trichuris	1
Ascaris	4

Of these 50, three were on leave from their regular duty stations and 20 were transferred to ships with medical officers after only 1 treatment. No follow-up was obtained on these 23 patients. Twenty-seven were followed through a complete course of 3 treatments.

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Therapy consisted only of hexylresorcinol (caprokol). One gram was given in each dose; it was preceded the evening before by 1 ounce of saturated solution of magnesium sulfate, and was followed in from 5 to 24 hours by another dose of magnesium sulfate. No food was permitted from the time of the first dose of purgative until 5 hours after the vermifuge. A stool specimen was always taken from the bowel movement resulting from a premedication dose of magnesium sulfate. From 3 to 11 days were allowed to elapse between treatments, and a patient was not considered physically qualified for transfer to craft without medical officers until he had been proved definitely free of ascaris ova.



3. Photomicrograph of head of Ancylostoma duodenale.

Ascaris was believed to be the only parasite which might prove dangerous on board Naval vessels because of its mode of transmissal, so the treatment was aimed at the elimination of ascaris ova from the stools. After one treatment, one-third of those with ascaris infection were found to have no ova in their feces. After two treatments, 4 percent still had ova in their stools. After the third treatment was completed, no ascaris ova were found in any of the patients' stools.

The hookworms were tremendously decreased after three treatments, but were still present in about one-fourth of the cases. Trichuris trichiura was scarcely affected by the treatment.

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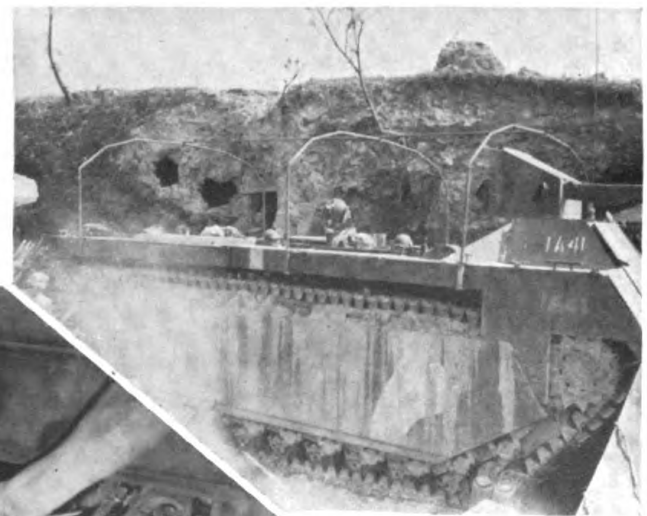
MEDICAL AND SURGICAL DEVICES

AMPHIBIOUS TRACTORS AS MEDICAL FACILITIES IN THE FIELD

WORTH M. GROSS
Lieutenant (MC) U. S. N.

In the May 1945 BULLETIN appeared an article on "Medical Utilization of Amphibious Tractors." Many of the suggestions presented therein by the author have since been tried out in combat operation, and an attempt is made here to summarize the advantages and disadvantages of the LVT–3 as a medical facility.

A canopy framework was constructed in the field by an ingenious maintenance section of an amphibious tractor battalion. It consisted of three cross ribs and one midsagittal rod, of ¾-inch pipe (fig. 1), secured in three "C" type clamps on both sides of the tractor. Over



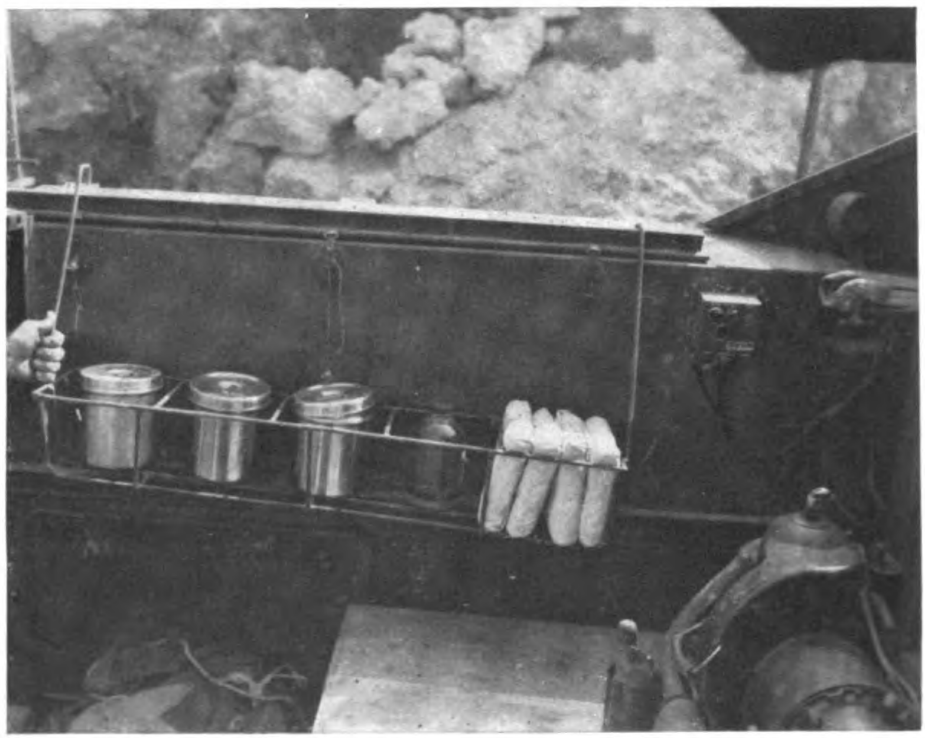
1. (Right). Cross ribs and center rod to carry tarpaulin cover for weather or a black-out.



2. Hot water feed tapped to port radiator. A temperature gage is indicated by an arrow.

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this framework a tarpaulin was stretched and a black-out setup was easily achieved. This can be removed from one tractor and placed on another in a matter of very few minutes. It in no way impaired the tactical use of the tractor. The outside installation of the holding clamps allowed the topside of both pontoons to be used as shelving space.



3. Compartmented rack for dressing materials.

A hot-water system attached to the port radiator is shown in figure 2. Ten to fifteen gallons of water can be used without hampering the engine or necessitating refilling the radiator. This setup requires only a few minutes to attach.

A compartmented rack was constructed of 3/8-inch steel rods (fig. 3) that was hung along the portside interior of the tractor, forward. This rack provided protection for such fragile materials as plasma and dextrose bottles, and facilitated their use.

A plywood table, 36 by 20 inches, with combing (fig. 4), was fitted with a single folding leg, and hinged to the after inside armor plate. This table in no way interfered with the larger operating table and was used to good advantage as a utility table.

Both engines, in only a few minutes' running time, can heat the interior of the tractor very comfortably. Cans of C and 10-in-1 rations can be heated simply by putting the cans over the manifold for a few minutes.

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4. Light plywood dressing table.

None of the above-mentioned installations had to be removed or further secured when the tractor was being driven. This factor alone saved much time in moving, and black-out could be maintained constantly while the tractor was being moved.

A camouflage net was kept in all tractors and could be used at the discretion of the medical officer.

Since all these installations were temporary it was unnecessary to fix one tractor and assign it as a medical tractor permanently. These appliances were adaptable to all LVT–3s and hence no special tractor was maintained.

An amphibious tractor draws enemy fire and if used as a medical facility it must not be exposed to enemy observation. There were many instances in which the side armor turned sniper fire.

One objection to the tractor as a battalion aid station was the inadequate space it provided. It was usually necessary to pitch an adjoining tarpaulin to handle the large influx of casualties. Never-

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theless the tractor provided a place to treat isolated cases that required immediate surgery and furnished transportation for the long and frequent forward displacements, when no other form of transportation was available.

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INSULIN THERAPY AND ELECTROSHOCK

At this time our practice is to give all acute cases insulin therapy and, if they do not show marked improvement at the completion of 20 insulin shocks, to add electric therapy to the insulin in the third hour of the insulin coma. However, with manics, markedly agitated involutionals, and catatonic schizophrenics, we begin the electric and insulin treatment concurrently.—TAYLOR, J. H.: Shock therapy—1937 to 1944. J. M. Soc. New Jersey 42: 300–304, September 1945.

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PENICILLIN ORALLY FOR GONORRHEA

Each patient ingested a total of 1.6 million units of penicillin over a 2-day period. The dosage schedule involved taking 100,000 units every 2 hours during the waking period. In all instances only negative cultures were obtained following treatment and all clinical signs and symptoms of gonorrhea disappeared.—FREE, A. L.; HUFFMAN, L. F.; TRATTNER, H. R.; and BROWN, H. B.: Oral penicillin in treatment of gonorrhea. J. Lab. & Clin. Med. 30: 738–740, September 1945.

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SULFADIAZINE AND SULFAMERAZINE IN MENINGOCOCCIC MENINGITIS

Two hundred seven patients with meningococcic meningitis were treated with sulfadiazine or sulfamerazine over a 3-year period. The gross mortality was 10.1 percent. There was no significant difference in the case fatality rate in patients treated with the two drugs. In a small group alternated between sulfamerazine and sulfadiazine, there was no appreciable difference in the results obtained. There was no relationship between the concentration of the sulfonamide in the blood and the outcome in meningitis. Massive doses of these drugs are not necessary for most patients with meningococcic meningitis.—SWEET, L. K.; DUMOFF-STANLEY, E.; and DOWLING, H. F.: Meningococcic meningitis treated with sulfadiazine and sulfamerazine; a 3-year study. Ann. Int. Med. 23: 338–348, September 1945.

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USE OF THE LSV FOR EVACUATION AND CARE OF AMPHIBIOUS COMBAT CASUALTIES

ABRAHAM KAPLAN
Captain (MC) U. S. N. R.

The LSV (landing ship, vehicle) was originally designed to land vehicles close to the beach of combat and to depart promptly. It was soon recognized, however, that it offered unusual facilities for the evacuation and care of combat casualties during the early assault combat phase.

Our LSV carried a number of vehicles with a variety of cargo. As the ship approached its designated position, the vehicles were unloaded via the ramp as well as over the side. The vehicle deck, which ran the entire length of the ship, then offered a spacious area for setting up a medical unit.

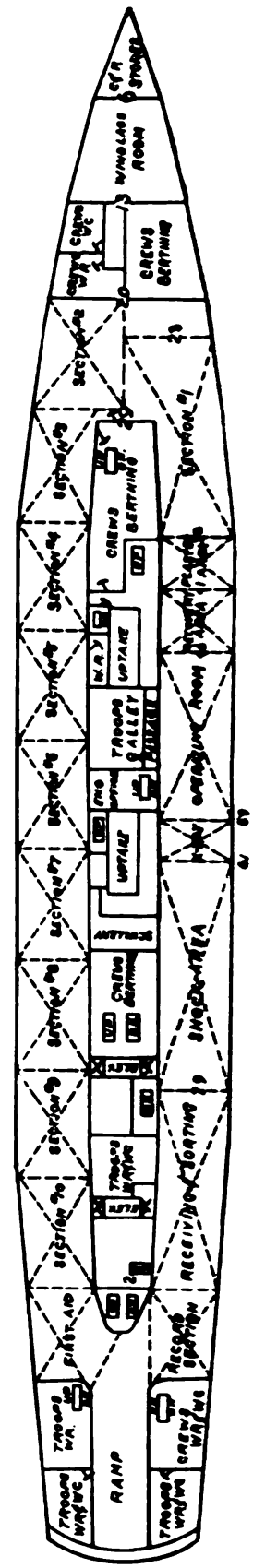
As will be noted in the sketched plan the vehicle deck was arbitrarily divided into sections. On the starboard side from aft forward there were the (1) record section, (2) receiving and sorting section, (3) shock area, (4) x-ray, (5) operation section (4 operating tables), (6) recovery area, (7) plaster area, and (8) 2 sections for patients.



1. Troop galley converted into surgical utility room.

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2. Medical plan of vehicle deck.



The entire port side was devoted to patients and was divided into 8 sections, making a total of 10 sections for acute combat casualties on the entire vehicle deck.

Various printed signs distinctly marking the location of these sections were suspended from overhead supports within full view, and each section for patients was numbered and designated for some special type of casualty; i. e., abdominal, orthopedic, chest, or head.

In sections marked off for patients, cots were installed fore-and-aft four abreast with a main passage in the center. The cots were secured to the deck to avoid sliding if the ship should roll. This was accomplished by securing 6-inch sections of 2-inch pipe, spot welded to the deck, and with wire cables with turnbuckles running between each pipe section stretched lengthwise parallel to the vehicle deck. The placing of the cots over these cables and lashing them at each end to prevent their moving in the event of rough weather worked admirably. Two hundred sixty-six cots with mattresses, mattress covers, and blankets were placed on the vehicle deck. Within arm's reach two parallel wires, supported from overhead bars by metal rods, were strung the length of the vehicle deck. They served as convenient supports for bottles of blood, plasma, and other intravenous medications.

The troops' galley was converted into a utility and surgical sterilizing room (fig. 1). Part of this galley was also used by the pharmacy. The scullery was used for the preparation and distribution of fruit juices, coffee, hot broth, and other refreshments.

Among other desirable facilities offered by the LSV were a generous number of heads and showers, a large storage space for medical supplies and equipment, and a large refrigerator specially equipped for the storage of whole blood at 45° F.

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Casualties could be taken aboard close to shore. They were often taken on at night. When the sea is not too choppy casualties can come aboard the vehicle deck in ducks via the ramp. Most of the casualties, however, were hoisted aboard by means of cranes and slings. They were placed on the elevator and lowered to the vehicle deck, and then brought to the receiving and sorting section where the staff of the record section was awaiting them. The casualties then proceeded in "assembly-line" fashion through the various departments and to assigned sections. Litter casualties were grouped on the vehicle deck depending on their type of injury. Postoperative patients first went to the recovery section for further observation and treatment until their condition was sufficiently satisfactory to permit transporting them to a specified section. The critically ill patients were kept close by, under observation of the operating surgeon, and were assigned special watches. Ambulatory patients and those whose condition was sufficiently improved to be transferred were assigned to the troop compartments.

The LSV when properly set up offers splendid facilities for the swift and efficient care of combat casualties. It can conveniently accommodate 300 to 350 litter patients and 500 ambulatory patients. This ship can come close to shore and render its best service during the early assault phase. It can rightly be named the "assault hospital ship."

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INJURIOUS EFFECTS OF ULTRAVIOLET ON SKIN CELLS

That ultraviolet radiation causes injury to epidermal cells is indicated by the histologic changes accompanying sunburn. On the appearance of gross erythema, enlargement and engorgement of the capillaries becomes marked; intracellular edema, and migration of leukocytes into the epidermis and into the corium in the region of the capillaries occur. As early as 24 hours after the exposure, degenerative changes in the prickle cells are detectable; these progress and may eventually involve all of this layer. The basal cells are less affected as a rule, but may also show degenerative changes; repair usually takes place through proliferation of cells of this layer.—BLUM, H. F.: Physiological effects of sunlight on man. Physiol. Rev. 25: 483–530, July 1945.

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SEABEE SICKBAY

FRANKLIN K. HOLZWARTH
Commander (MC) U. S. N. R.
and
WILLIAM W. THRALLS
Chief Pharmacist's Mate U. S. N. R.

The layout presented is that of a sickbay used for a construction battalion. This represented a composite of the most utilitarian features of six previous semiexperimental installations.

Figure 1 shows the front elevation of the two Quonset huts, with waiting outdoor alcove and connecting unit.

The forward end of the dispensary hut (fig. 2) was used for sick call, as dressing room, and as record room. In the center was a long, double-decked dressing table, with rounded ends which held basins and waste pails in recesses (fig. 4). In the midline of the tabletop was placed a row of aluminum-covered containers, one for instruments hanging on a rack in disinfectant solution, others for applicators, tongue depressors, sterile pads, bandages, and cotton cut in 1-inch squares so that it could be plucked when the corpsman had only one free hand. This table was accessible from both sides and narrow enough to enable one to reach across it. Several attendants could use it at the same time, without getting in each other's way, as is often the case when dressing tables are placed against a wall or in a corner.

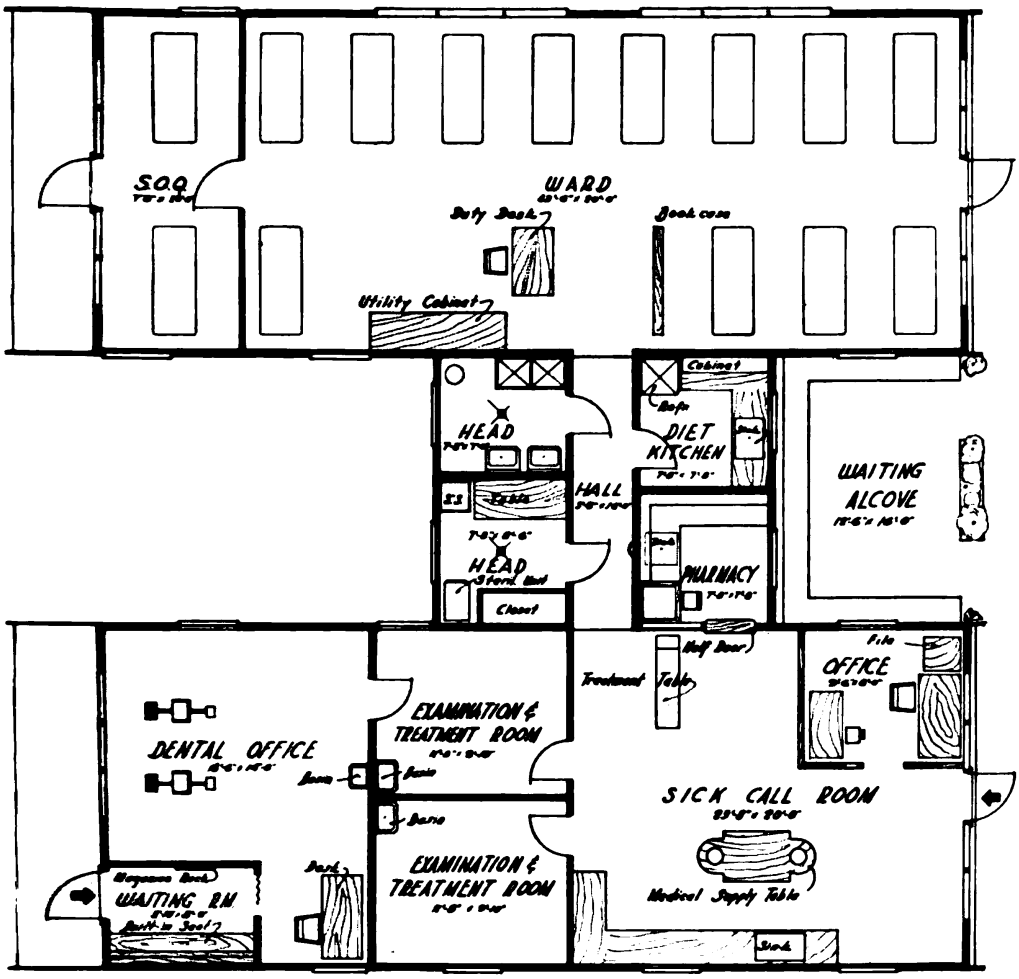
Covers were removed from all the containers during sick call, for expediting the handling of utensils. Frequently used solutions and instruments such as bandage scissors, forceps, hemostats, etc., were laid out in a sterile towel on a tray. The lower shelf served as a receptacle for jars of various ointments and medications.

The 2-foot strips of the outer walls of the dispensary Quonset and the ward Quonset as well were screened for ventilation. One strip



1. Front elevation of Quonset hut dispensary.

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2. Dispensary and ward floor plan.

extended down to floor level, the other was shoulder-high. The metal sides of the Quonsets were hinged at the upper edge opposite the screens, to be dropped in case of rain. Open wall-cupboards housed basins, trays, pitchers, large adhesive rolls, etc. A dust-tight instrument cabinet with twin doors was built against a bulkhead. A metal treatment table for hospital corpsmen's use in giving rubs, heliotherapy, and dressings, stood against one wall. Chairs and benches were provided for foot-soaks.

The rear of the dispensary Quonset housed a 20-foot-square dental department (fig. 3), with 2 dental chairs, waiting room, cuspidors, and record desk. It had a 4-foot outside porch. The ward Quonset had 12 beds in addition to the 2 in the S. O. Q. room and also an outside porch. Both Quonsets had tropical roofs with the ceiling screens on a 40° pitch inward and downward to prevent rain from beating in. All floors were of smooth-troweled cement, except in the dental department, where a plywood floor was used for greater resiliency.

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The pharmacy and laboratory opened off the dispensary by a Dutch door. A wall-type porcelain scuttlebutt, just outside the pharmacy, facilitated the ingestion of tablets and capsules and obviated use of the common cup. Adjacent to the ward was the galley, opening off the "cross-bar" hallway of the H, which connected the dispensary with the ward. Opposite the galley was the sterilizing room and clean-linen closet. Adjacent to this was the head, with a shower in a metal corner-stall.

Between the dressing room and the dental office were two combination medical officers' offices and examining rooms, each with desk,



3. Dental office.

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4. Sick call and treatment room and record office. The improvised dressing table is shown in center.

examining table, and wash sink. Plywood partitions afforded quiet and privacy. The size of these rooms was ample for the thorough study of each patient.

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EFFECTS OF SUNLIGHT

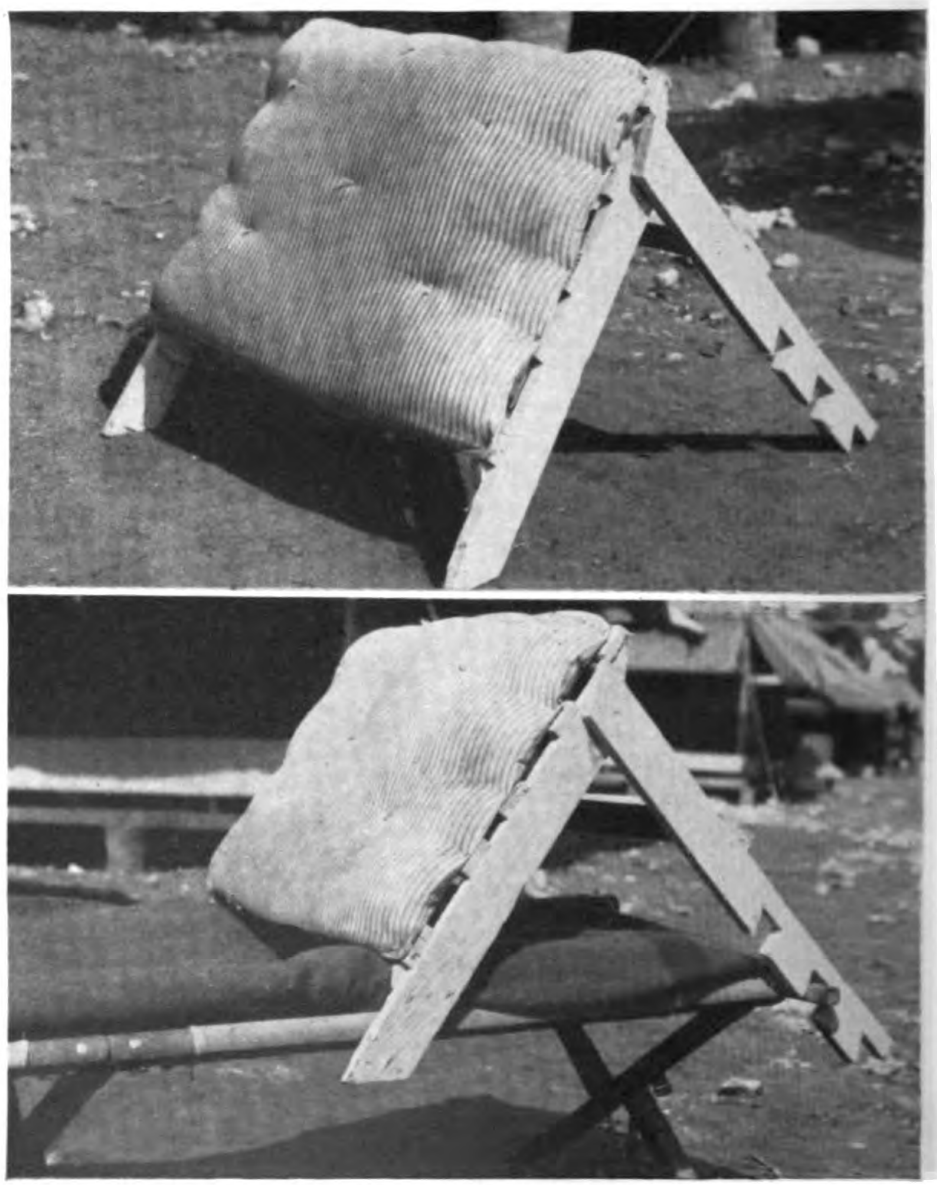
There exists a widespread belief in the beneficial effects of sunlight, which finds expression in the fad of sun-bathing. This belief stems in part from false analogies that have been drawn. For example, the idea that since sunlight is beneficial and necessary to plants it must be beneficial and necessary to man, however absurd, is found frequently in scientific literature, sometimes directly stated, sometimes implied. The detrimental effects of sunlight have received much less consideration and publicity, yet when one undertakes a critical review, he is struck by the fact that the balance is weighted heavily on the side of effects which appear injurious rather than beneficial.—BLUM, H. F.; Physiological effects of sunlight on man. Physiol. Rev. 25: 483–530, July 1945.

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ADJUSTABLE BACK REST FOR FIELD HOSPITAL COT

GEORGE L. WATKINS
Lieutenant (MC) U. S. N. R.

A back rest designed to fit the field medical folding cot (Stock No. 14–325) is suggested as an added comfort for bed patients in field hospitals.



Adjustable back rest.

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It is constructed of 1-inch lumber and built in two sections. The back rest proper consists of five 1- by 2-inch crosspieces fitted to uprights on either side, spaced the width of the cot. A wooden "rocker" on the inside of the lower end of these uprights rests upon the sides of the cot, holding the back rest in place and allowing clearance space for the mattress. A piece of surveyed mattress, folded under at the top to give a pillow effect, is tacked over the crosspieces.

The supporting section consists of two legs braced by a 1- by 2-inch crosspiece. The lower ends of the legs are notched. Each leg is attached to the back rest at the top by a ½-inch bolt or a large nail cut off and bradded over a washer.

The desired height and pitch of the back rest may be obtained either by fitting the leg notches over the cot stick ends or by sliding the "rockers" to the desired position along the sides of the cot.

The back rest described has several advantages: (1) It is light and easily fitted and removed; (2) it may be adjusted to any desired height; and (3) it is simple to construct.

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BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.
(For review)

MODERN PSYCHIATRY, *by William S. Sadler, MD., F.A.P.A., Chicago, Consulting Psychiatrist to Columbus Hospital; Consultant in Psychiatry, The W. K. Kellogg Foundation.* 896 pages. The C. V. Mosby Co., St. Louis, Mo., publishers, 1945. Price $10.

This is an extremely difficult book to review. In it the author states that he is endeavoring to tell the story of "personology"—"the difficulties human beings have in adjusting themselves to life." He states that he is endeavoring to place before the general practitioner of medicine, as well as specialists and psychiatrists, the problems of personality, maladjustments, the neuroses, and the psychoses.

Beginning with the introduction, a somewhat sketchy discussion of psychosomatic medicine, the author proceeds in part I to discuss personality problems, part II the psychoneuroses, part III the psychoses, part IV general psychotherapeutics.

Part I contains 20 chapters of approximately 200 pages with numerous subtitles. To mention but a few there are "Eight kinds of lying," "Technique of efficient adjustment," "Making the best of what we are," "Swimming sensations," and "Disposing of one's self as a problem." This should give the psychiatrist some idea of the tenor of part I.

It is not ncessary to go through all the various chapters. The sketchy treatment of various problems makes it difficult reading. The chapter on the "War neuroses" makes no mention of the special selection methods of the Navy or air forces and shows a lack of familiarity with the problem in general. There is little or no reference to the excellent work which has come out of the war. There are 39 lines of a rather naïve discussion on the "Neuroses appearing under combat."

It seems as though the book tries to be all things to all people. In the discussion of the sexual problem, the author gets over and out of the subject of psychiatry and into the question of morals. He makes

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one statement on page 336 relative to the morality of masturbation with which every moralist of any persuasion will disagree.

In his considerations of psychoanalysis the author has failed to consider the present trends of analysts like Alexander, Grinker, Murray, and others, for a more dynamic and shorter form of treatment. The influence of Dubois upon the author is seen throughout the volume, although he denies it; nevertheless it crops out at regular intervals.

On page 696 the author states "The strong mind acts slowly; the weak mind acts quickly on the spur of the moment." This reviewer's mind acted quickly on this work. Perhaps that is the reason for his failure to find this book particularly valuable.

PSYCHIATRY IN MODERN WARFARE, *by Edward A. Strecker, A. M., M. D., Litt. D., LL. D., Professor of Psychiatry and Chairman of the Department, School of Medicine, University of Pennsylvania; and Kenneth E. Appel, Ph. D., M. D., Sc. D., Assistant Professor of Psychiatry and Chief of Clinic, School of Medicine, University of Pennsylvania, Lecturer in Psychiatry, School of Neuropsychiatry, U. S. Naval Hospital, Philadelphia.* 88 pages. The Macmillan Company, New York, publishers, 1945. Price $1.50.

In a compact pocket-size book the authors have set forth the story of psychiatry in relation to the war. In addition to observations resulting from their wide experience, there is incorporated a summary of the contributions of a wide selection of other observers.

The book is divided into two parts, "Psychiatry and the Two World Wars," and "Demobilization and the Return to Civilian Life."

In part one, the differences between the two wars are considered, particularly in regard to the psychologic circumstances bearing upon both soldier and civilian. A comparison is made of the psychiatric experiences during the two wars, and of the significance of this experience in the postwar period. Parenthetically, one minor factual error, which however does not detract from the value of the book, is noted in the statement that "For a long time, however, the Navy largely disregarded screening tests and used the trial by duty test in boot training." Actually the plans, including screening tests, for detection and elimination of psychiatrically unfit recruits were completed by the Navy in 1940, and the plan was in operation by the middle of 1941, well before the outbreak of the war.

Part two considers the problem of demobilization. In a direct and understandable presentation, the "why" and "how" of psychologic adjustment during this period are discussed from the standpoint of the veteran, his family, employers, and friends.

The book is of value to all who are concerned with any phase of the rehabilitation of returning servicemen, as well as to those who are interested in the problems of personal and social adjustment which have been created or brought into focus by this war. It is to be recommended as a summary for those familiar with the many writings on

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the subject, and as a concise over-all review for others, both physicians and laymen. All in all the book represents an excellent and very readable distillation of the pertinent knowledge of its subject to date.

PULMONARY TUBERCULOSIS IN THE ADULT, *by Max Pinner, M. D., Chief, Division of Pulmonary Diseases, Montefiore Hospital for Chronic Diseases, New York; Editor, American Review of Tuberculosis; Clinical Professor of Medicine, College of Physicians and Surgeons, Columbia University, New York.* 579 pages; illustrated. Charles C Thomas, Springfield, Ill., publisher, 1945. Price $7.50.

Contained within the 580 pages of this volume is a series of pithy but comprehensive essays covering the subject of tuberculosis, designed to acquaint the workers in each of the fields of tuberculosis endeavor, with the progress of the workers in all the fields. Modern knowledge is summarized in the author's clear, incisive, and at times picturesque style. Following each essay is a bibliography with a brief criticism of the content of the references.

The book will be especially helpful to doctors faced with the problem of how to handle the patient who presents minimal or incipient pulmonary disease, and its publishing at this time is particularly apropos in view of the wide interest in case-finding by means of mass chest x-raying.

Of minor editorial interest are the following items: The use of "granula" for "granules" on page 11; "stabile bacillus" and "stable culture" on pages 12 and 13; occasional omission of verbs; and rare typographic errors in spelling. The author disagrees with Dorland's spelling of "dissociant," apparently preferring "dissociate." "Autoptic" examination is not found in Dorland's dictionary, either. These items do not detract from the essential value of the text, but on the contrary, add to the interest of the reading.

It is recommended that this book be given immediate and wide circulation within the service and that copies be placed in the hands of members of Boards of Medical Survey as well as medical officers in charge of hospital wards and case-finding units.

A MANUAL OF SURGICAL ANATOMY, *prepared under the auspices of the Committee on Surgery of the Division of Medical Sciences of the National Research Council, by Tom Jones and W. C. Shepard,* 195 pages. W. B. Saunders Co., Philadelphia, Pa., publishers, 1945. Price $5.

Early during World War I the need of a surgical atlas was recognized. Jones and Shepard were assigned the task. There appeared at the time, not long before the war's end, a compact atlas of surgical anatomy of unexcelled quality. Its usefulness to the general surgeon in the field was apparent.

Again the same task was assigned to the same two medical artists, now grown illustrious in their chosen field. The present volume, which is the last of the series of military surgical manuals edited by the Committee on Surgery of the National Research Council, reflects

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the mastery which comes to those whom nature has endowed with rare talents, and hard work has polished to a pre-eminent brilliance.

The Manual of Surgical Anatomy is an exact work, one upon which a surgeon can rely. In its compactness nothing of importance is sacrificed. The illustrations are as revealing as the dissector's knife. One would wish, however, that some of the pen and ink drawings were of a bolder impression. Starting with the skull and progressing in anatomic order, all the structures of importance from the viewpoint of the surgeon have been excellently and accurately portrayed. The surgeon may unhesitantly follow the drawings as a guide in the various surgical approaches. The volume is textless. Each illustration, however, is sufficiently labeled to give a complete and comprehensive picture, making further text superfluous. A glossary of terms is incorporated with the index, a feature materially adding to the value of the work. The Manual of Surgical Anatomy should be found on the desk of every surgeon, whether in or out of the armed forces.

CANCER OF THE COLON AND RECTUM, Its Diagnosis and Treatment. Second Printing. *By Fred W. Rankin, B. A., M. A., M. D., LL.D., Sc. D., F. A. C. S. Surgeon, St. Joseph's and Good Samaritan Hospitals, Lexington, Ky.; and A. Stephens Graham, M. D., M. S. (in Surgery), F. A. C. S., Surgeon, Stuart Circle Hospital, Richmond, Va., Assistant Professor of Surgery, Medical College of Virginia.* 358 pages; illustrated. Charles C Thomas, Springfield, Ill., publishers, 1945. Price $5.50.

The second printing of this book testifies to its value. Although only a small volume, it contains information on a subject of the greatest importance in surgery. Legibly written and excellently illustrated, this text is a contribution to the literature on cancer and should be found in the library of every surgeon who contemplates colonic and rectal surgery.

The book is divided into three parts, the first of which contains a general consideration of the anatomy, physiology, pathology, etiology, and diagnosis of cancer of the colon and rectum. In the second part the operability and prognosis of carcinoma of the colon and rectum are discussed as well as the choice of operation. In the third part, the operative procedure in surgery of the colon, recto-sigmoid, rectum, and anus is depicted in sufficient detail to permit the ordinary surgeon to absorb and follow in any contemplated operation.

Few living surgeons today have accumulated the wealth of information about one subject as has Rankin about carcinoma of the colon and rectum. This wealth of information he has put down in a simple manner in a very comprehensive small volume.

The innumerable statistics referable to various authorities in support of the authors' theme makes the first part of the volume slow reading and somewhat confusing. This is compensated, however, by the discussion in the third part of the book where the Rankin opera-

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tive technic is depicted step by step so lucidly that the reader is able to visualize an operation occurring before him.

The subject of radiotherapy of carcinoma of the rectum and associated parts, its advantages and disadvantages, is written by Fred M. Hodges, eminently competent in this field, and rounds off the general subject of therapy.

The limited reference list (and those publications that are given include mostly the authors' contributions), may be considered by some a shortcoming in a volume of this character. It is admitted that the literature on cancer of the colon and rectum is inexhaustible, and if the lack of a more comprehensive list may be cited as a shortcoming of the volume, it should be pointed out that most readers of Rankin's work are searching for the opinion of an outstanding, recognized international authority and are not concerned about the kaleidoscopic viewpoint of others in this field.

FACIAL PROSTHESIS, *by Arthur H. Bulbulian, M. S., D. D. S., F. A. C. D., Director, Museum of Hygiene and Medicine, The Mayo Foundation, Rochester, Minn.* 241 pages; 202 illustrations. W. B. Saunders Co., Philadelphia, Pa., publishers. 1945. Price $5.

"Facial Prosthesis" represents a treatise of remarkable clarity by a man who is unquestionably the outstanding authority in this field in the United States and probably the world. The book is a clean-cut description of indications, technics, and matériel for facial prosthesis and is profusely illustrated. The reader is impressed with the extreme neatness of all the illustrations; they reflect a basic refinement in thought and laboratory methods of the author.

In the introduction, Dr. Bulbulian says, "The wearing of artificial dentures, the most common type of intra-oral prosthesis, is an accepted necessity of today. There is no reason why an extra-oral restoration, which in some instances is even more essential, should not be accepted in the same manner." He also points out that the dentist, because of his familiarity with dental materials and technics of impressions and casts, is better qualified to undertake facial prosthesis than anyone else. He points out, in addition, that the closest cooperation must be maintained between the plastic surgeon and the dental prosthetist.

There is an excellent summary of the ideal qualities to be sought in a facial prosthetic material and the author states that all desirable qualities are not yet available in any prosthetic material, but that plasticized plastics are superior to all others both in appearance and durability. In view of this statement by the author, one criticism of the book can be made, and that is that while the book deals with restorations built of latex, only a moderate amount of space is devoted to the plasticized plastics. The section on retention of facial prostheses is exceptionally well done.

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Although the results illustrated in the book are practically faultless from a photographic standpoint, the enthusiast should bear in mind that there are many disadvantages to the wearing and maintenance of a prosthesis throughout a lifetime and it is sometimes desirable to build a part from the patient's living tissue even though the cosmetic result is inferior photographically to the prosthetic device. Decision as to the use of prostheses should rest with the plastic surgeon, and Dr. Bulbulian's book will be found valuable for both the plastic surgeon and the dental prosthetist working in close collaboration.

PHARMACOLOGY AND DENTAL THERAPEUTICS. A Textbook for Students and Practitioners, *by Hermann Prinz, A. M., D. D. S., M. D., Sc. D., Dr. Med. Dent., Professor Emeritus of Materia Medica and Therapeutics, School of Dentistry, University of Pennsylvania; and U. Garfield Rickert, A. M., D. D. S., late Professor of Diagnosis, Dental Therapeutics and Radiology, School of Dentistry, University of Michigan.* 9th edition, rewritten and revised by Edward C. Dobbs, D. D. S., Associate Professor of Pharmacology, Dental School, University of Maryland. 566 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1945. Price $6.50.

This is the ninth edition of a work which has long been recognized as one of the standard textbooks on dental materia medica, pharmacology and therapeutics. The title of the first seven editions, "Dental Materia Medica and Therapeutics," was changed in the eighth edition to be more in harmony with the modern concept of pharmacodynamics.

The contents of the present edition, essentially the same as that of former editions, have been rearranged and grouped under their chief sites of action. This has resulted in a text much more easily read and one in which interest is held by a thread of continuity. Several chapters have been completely rewritten and brought into consonance with recent thought.

The reader will find the book interesting, authoritative and easily followed.

OPERATIVE DENTISTRY, *by Clyde Davis, A. M., M. D., D. D. S., former Professor of Operative and Clinical Dentistry and Dean of the Faculty, at this time Lecturer in the Section of Operative Dentistry, The University of Nebraska, College of Dentistry, Lincoln, Nebr.* 5th edition. 432 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1945. Price $7.50.

In the fifth edition of this text, the author has adhered to his original aim, expressed in his preface of the first edition, of meeting the demand for a condensed treatise on operative dentistry which would enable the dental student to master the salient features of the subject in a limited time.

The book is profusely illustrated and covers all of the operations which are considered to be in the field of operative dentistry in its broader sense; that is, "all surgical and therapeutic procedures on the natural teeth and their supporting structures except the removal of

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such teeth." The chapters on preventive dentistry, periodontia and endodontia, are of special interest.

In summation it may be said that the book is well done and will achieve the purpose for which it was produced.

STILL MY WORLD, *by Sergeant Leonard Foulk and "C. W."* Pacific Union College Press, Angwin, Calif., publishers, 1945. Price $1.50.

The book, Still My World, is a very interesting and instructive publication on war-incurred blindness. The writer's description of his personal reactions to his blindness and his experiences during his period of learning how to live a normal life in spite of his handicap should be an inspiration to other men who have the same adustment to make, and presents food for very careful thought by all who are concerned with the care of the war blinded. The wise, sympathetic guidance and assistance he had from "C. W." sets a pattern for good case work in treating these men as individuals. His hearty enthusiasm for his guide dog might lead the reader to overlook his cautions that decision regarding a dog must be appropriate to each blind individual's personality and circumstances.

The book should be thoughtfully read by all who come in contact with the war blind, whether as teachers in hospitals or as relatives and well-wishers in civilian life.

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PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge

ARSENICAL POISONING

THOMAS K. RATHMELL
Commander (MC) U. S. N. R.

Some pharmaceutical houses distribute 0.06-gm. and 0.6-gm. ampules of arsenical compounds, which except for labeling are practically indistinguishable. When prepared for injection, the same volume of fluid will totally dissolve the contents of either ampule, despite the fact that the 0.6-gm. ampule contains 10 doses of the drug, while the 0.06-gm. ampule contains but a single dose. The Borgian role of arsenic as a lethal agent has been revived.

The cases of arsenical poisoning to be presented were characterized by hepatic lesions, visceral hemorrhages, nephrosis, and hyperplastic changes in the bone marrow. The bone marrow changes in the subacute degree of poisoning were indistinguishable from the normoblastic erythropoietic hyperplasia one encounters in nutritional anemias. Those seen in the acute type were more extensive and involved both the erythropoietic and myeloid elements.

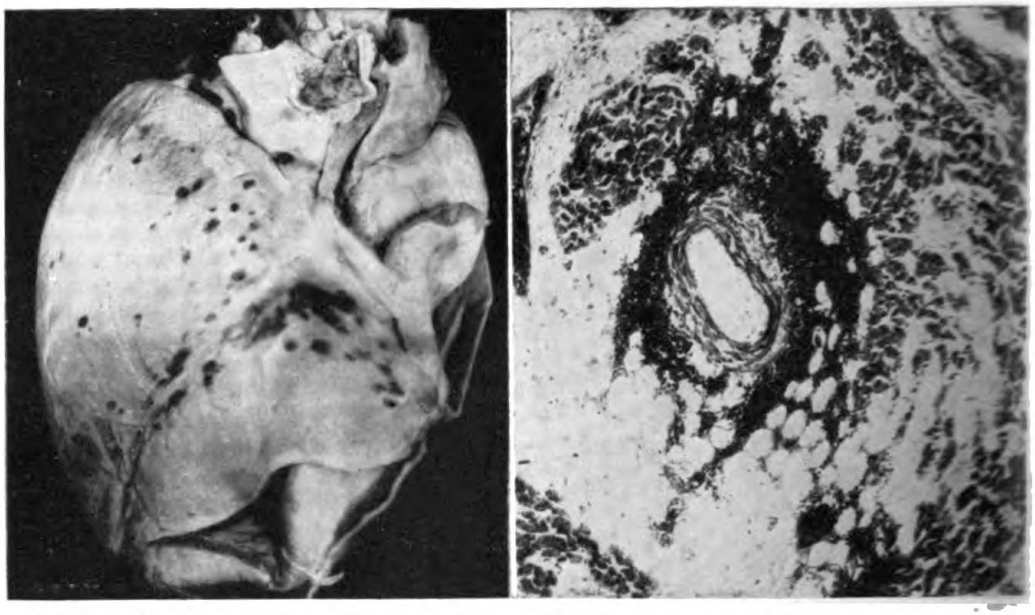
CASE REPORTS

Case 1.—A colored male, age 20 years, was admitted for medical observation. He had received 24 injections of mapharsen (1.41 gm.) and 18 injections of bismuth (2.34 gm.) during the previous 6 months. The last treatment was administered 5 weeks prior to the onset of nausea and vomiting. He died 7 days after admission to the hospital and approximately 6 weeks after the onset of symptoms.

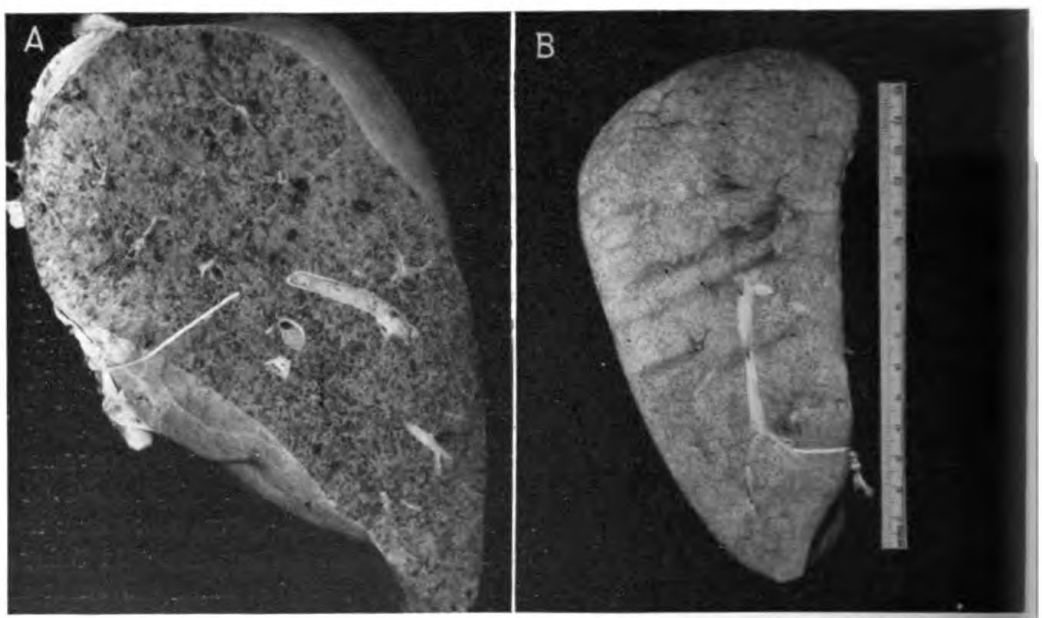
Prior to death his laboratory studies (which are reported as milligrams per 100 ml. unless otherwise specified), showed him to have a hemoglobin of 15 gm., erythrocyte count of 4.8 million, and leukocyte count of 5,500, with a preagonal rise to 21,300. His icterus index was 90.9, blood urea nitrogen 14.9, and nonprotein nitrogen 35.7, with a creatinine of 1.4 and a CO_2 combining power of 52 volumes percent.

Urine studies during this period showed that a high specific gravity (1.028) was maintained and that bile was present throughout his illness, with tyrosine and leucine crystals being noted about 48 hours prior to death. There was a terminal albuminuria of 35 mg. percent and a marked hematuria.

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1. Gross and photomicrographic views of the heart from a case of arsenical poisoning, subacute type, showing the subepicardial hemorrhages.



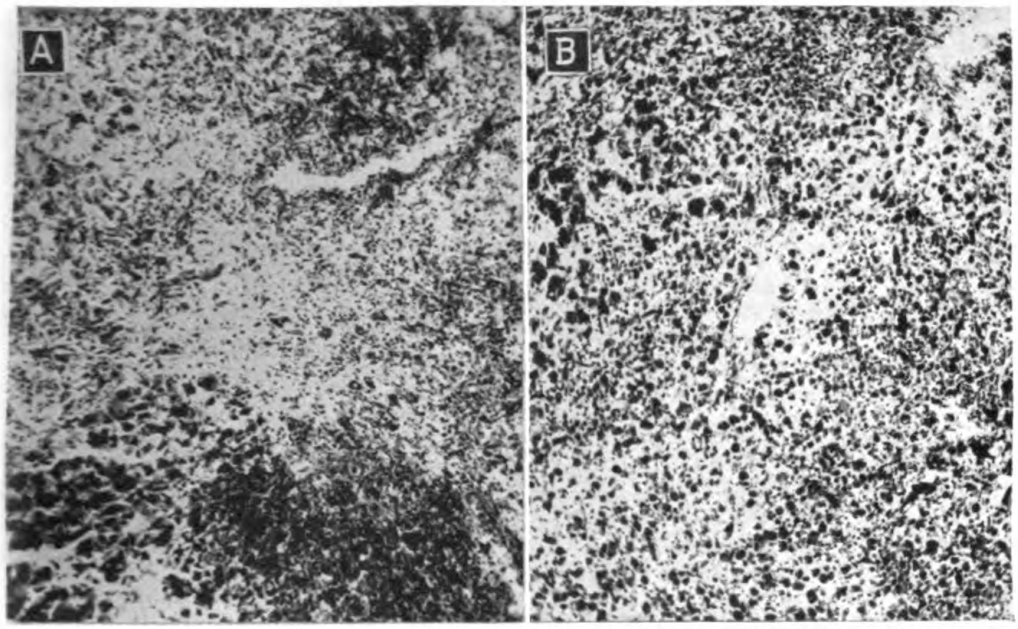
2. (A) Acute yellow atrophy of the liver from a case of arsenical poisoning, subacute type.

(B) Diffuse hepatic necrosis from a case of acute arsenical poisoning.

The spinal fluid showed a total protein of 26.4, sugar of 90.9, chlorides 740, no increase in globulin, Kahn negative and a colloidal gold curve of 3322110000.

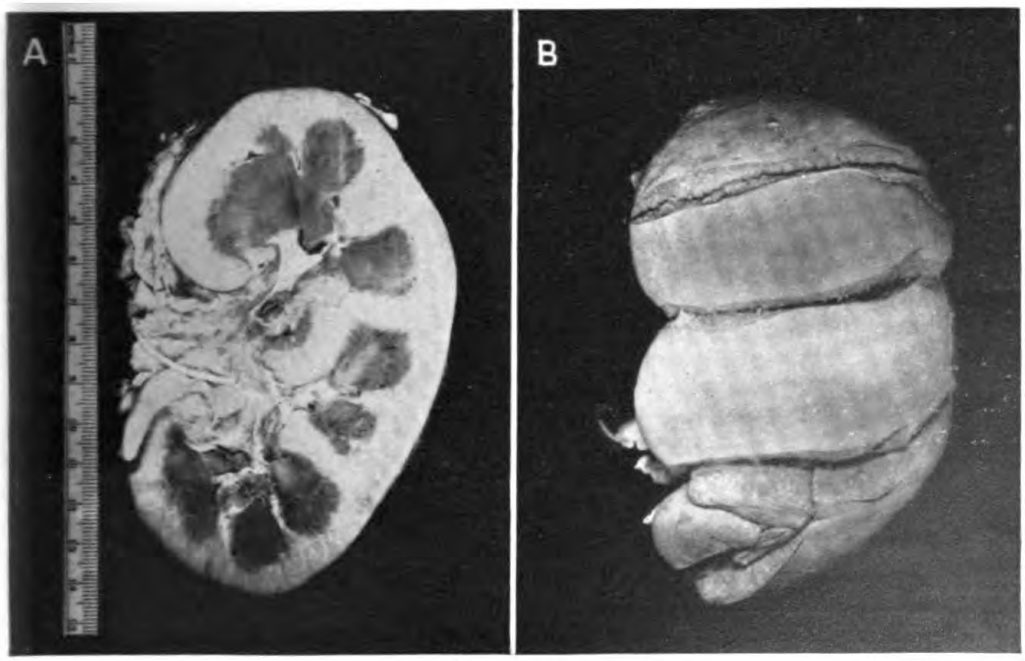
Postmorten examination revealed an intense icterus, which was most pronounced in the skin, sclera, pacchionian bodies, and throughout the endothelial lining of the vascular channels. There was a marked congestion of the viscera

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3. (A) Photomicrograph of liver in acute yellow atrophy from a case of arsenical poisoning, subacute type. Note necrosis about the central vein with preservation of a portion of the lobule.

(B) Photomicrograph of liver with diffuse necrosis due to acute arsenical poisoning. Note that there is a total loss of lobular architecture.



4. (A) Kidney showing nephrosis as result of acute arsenical poisoning.

(B) Spleen showing acute toxic splenitis, the result of acute arsenical poisoning, with subepicardial (fig. 1) and visceral pleura hemorrhages. There were ascites and bilateral hydrothorax.

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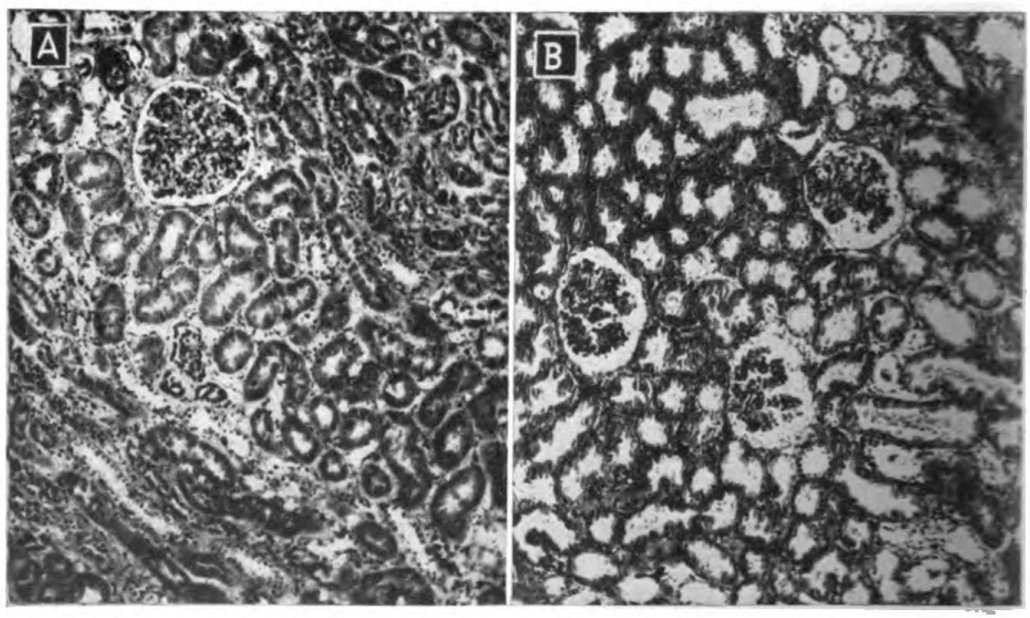
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The liver was atrophic, having an over-all measurement of 22 by 15 by 18 cm., and weighed 1,218 gm. It appeared pale brown. Small dark yellow areas were visible beneath the capsule. An increased resistance was noted on sectioning. The cut surface presented a variegated appearance (fig. 2A), brown and yellow areas of necrosis alternating with patches of dark red congestion. Histologic study showed an acute yellow atrophy (fig. 3A). The kidneys showed congestion and pallor on gross examination, while histologic study confirmed the presence of nephrosis (fig. 5A). The bone marrow was hyperplastic, chiefly erythropoietic in type (fig. 7A). The urine found in the bladder was a characteristic ocher yellow.

Positive tests for arsenic were obtained from the postmortem urine, hair, and nails in this case, while studies of the liver, brain, pleural fluid, and skin gave negative results.

Case 2.—A white male of 22 years was admitted to the hospital with a diagnosis of Vincent's angina. On the second day of hospitalization he was given an ampule of mapharsen (this was subsequently discovered to be a 10-dose ampule containing 0.6 gm. of the drug). Vomiting ensued within an hour. In 24 hours hepatic enlargement was noted and vomiting became more frequent and of a coffee-ground type. In 48 hours the patient was in coma. Death occurred within 72 hours after the administration of the arsenical.

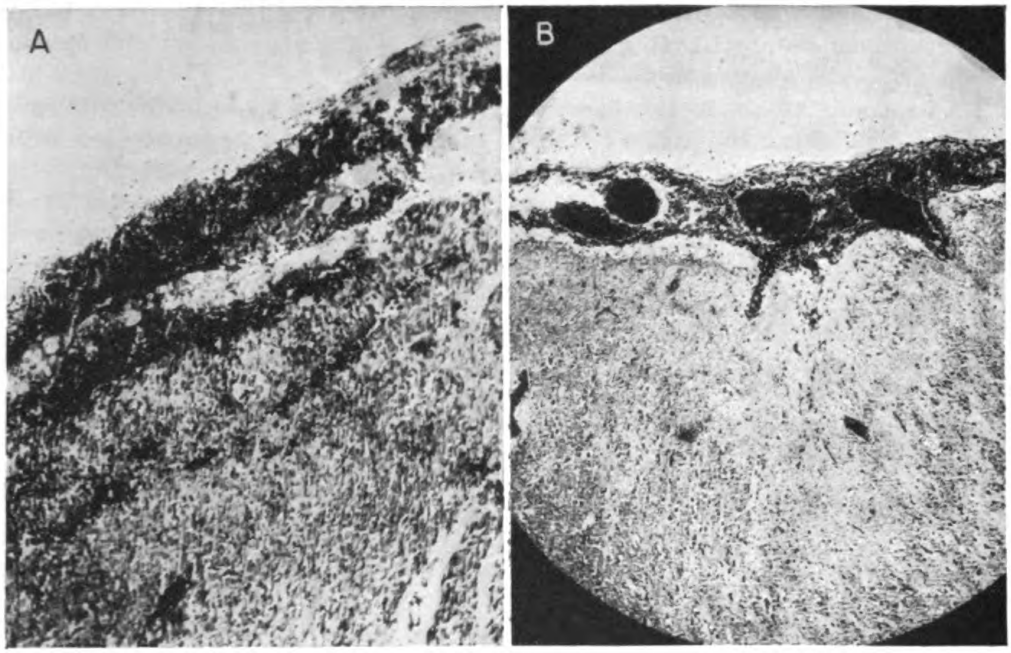
Laboratory studies following administration of this massive dose of arsenic showed that the patient had an icterus index of 44.9, nonprotein nitrogen 120, a CO_2 combining power of 42.2 volumes percent, a Hanger's test of 4-plus hemoglobin 12gm., erythrocytes 3.6 million, and leukocyte count 20,000. His urine, 48 hours after administration of the drug, was cloudy amber with a specific gravity of 1.014, acid in reaction, contained 40 mg. of albumin, was negative



5. (A) Photomicrograph of kidney showing arsenical nephrosis, the result of arsenical poisoning, subacute.

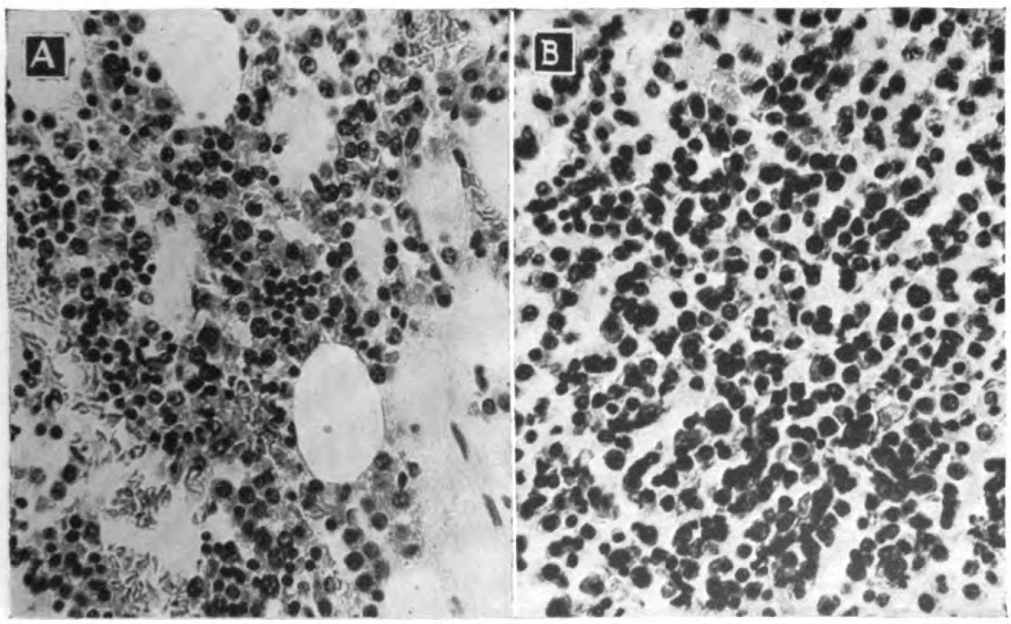
(B) Photomicrograph of kidney showing arsenical nephrosis, the result of arsenical poisoning, acute. Note albuminous material and erythrocytes in glomerular space.

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6. (A) Photomicrograph of heart muscle showing subendocardial hemorrhage from arsenical poisoning, acute.

(B) Photomicrograph of motor cortex showing subarachnoid hemorrhage from arsenical poisoning, acute.



7. (A) Photomicrograph of bone marrow seen in arsenical poisoning, subacute. Note hyperplasia, predominantly erythropoietic.

(B) Photomicrograph of bone marrow seen in arsenical poisoning, acute type. Note hyperplasia of both erythropoietic and myeloid elements.

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for sugar, loaded with red blood cells and leukocytes, positive for occult blood, and contained an occasional granular cast. Chemical examination for arsenic in the urine was positive on the day of his death.

Postmortem findings in this case were quite similar to those in the first case but the lesions encountered were of a fulminating type. Hemorrhages were present throughout the viscera (fig. 6A and B). The lungs showed acute congestion and hemorrhage; the left weighed 708 gm., the right 906 gm. There was an acute toxic splenitis (fig. 4B); the spleen measured 18 by 10.5 cm., and weighed 538 gm. The liver was enlarged, weighed 2,014 gm. and showed diffuse necrosis (fig. 2B). The cut surface was putty yellow with patches of acute vascular congestion distributed over its surface in an arboreal arrangement. The kidneys showed an acute nephrosis (fig. 4A); the left weighed 317 gm; the right 280 gm. The bone marrow was hyperplastic with a proliferation of both erythropoietic and myeloid elements (fig. 7B).

Chemical examination showed a heavy concentration of arsenic in the liver, less marked in the lung, and a faint trace in the brain, while the hair, skin, and nails were negative.

SUMMARY

Two cases of arsenical poisoning are presented in which the quantities of the metal administered as well as the elapsed time before death are definitely known. The characteristic gross and microscopic features of each case are illustrated. Pertinent toxicologic data are recorded. The stimulating effect of arsenic on the bone marrow is demonstrated.

CONCLUSIONS

1. The lesions encountered in arsenical poisoning depend on the dosage and manner of administration, these influencing the time interval which may elapse before death. A history of previous use of the metal, with possible development of tolerance, must be considered.

2. It appears desirable to have commercial preparations of massive doses of this metal marketed in diverse containers.

3. The therapeutic employment of arsenical preparations demands eternal vigilance if untoward complications are to be avoided.

4. Removal from the drug rooms and Supply Catalog of the 0.6-gm. ampule of mapharsen is recommended.



VENERAL DISEASE CONTROL

The weakest link in the venereal disease control chain is the lack of adequate examination and diagnosis of gonorrhea in the civilian female.—ABRAHAMSON, R. H., and HARRIS, E. H.: Cooperation in venereal disease control at naval training center; comparative results of first 6 months of 1944 and calendar year 1943. Am. J. Syph., Gonor. & Ven. Dis. 29: 551–556, September 1945.

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POISONING BY BARRACUDA-LIKE FISH IN THE MARIANAS

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The following is a combined report of 51 cases of poisoning by 2 barracuda-like fish in an officers' mess and in a Military Government camp on Saipan.

This report is of interest because of: (1) The severity of the neurotoxic manifestations and the persistence of residual symptoms in those eating at the officers' mess; (2) the importance of differentiating fish caught in the Pacific for use as food; and (3) the pertinent information about fish in this area received from a Japanese internee doctor.

The symptoms were more severe in the officers' mess probably because of larger quantities eaten, and possibly also because a larger fish was used. Natives do not eat barracuda-like fish weighing over 20 pounds, feeling that the larger are more likely to be poisonous.

Vonfraenkel and Krick[1] in 1945 cited cases of poisoning from a barracuda. Those poisoned had tingling of the mouth and lips immediately on eating, which perhaps prevented them from eating a sufficient quantity; they were not affected so seriously as were the officers in this report. In our outbreak, the fish was so palatable that many took second servings. Probably the offending fish in Vonfraenkel and Krick's report was also not a true barracuda.

EXPERIENCE AT THE OFFICERS' MESS

A barracuda-like fish weighing 55 pounds was caught about 0900, 17 May 1945, and kept in water in the boat until 1100. It was delivered to the officers' mess and refrigerated at 1400. After inspection the following morning, it was prepared at 0830 and fried, then inspected by the commissary officer and medical officer. It was served for lunch between 1200 and 1245. Within 2 hours all the 33 officers,

[1] VONFRAENKEL, P. H., and KRICK, E. S.: Fish poisoning by barracuda in Marianas. U. S. Nav. M. Bull. 44: 427–431, February 1945.

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including 3 medical officers, and 8 enlisted men who ate the fish were affected, the majority being seriously ill.

The meal consisted of fish, spinach, fried potatoes, lemonade, fruit salad, bread, and butter. About 2 hours after the ingestion of the meal, most began to feel symptoms of severe tingling and numbness of the tongue, hands, and feet, associated with generalized weakness. A few had diarrhea at the time, but no nausea or vomiting. Saline purgatives were given, followed by 2 gm. of sulfadiazine. All patients had excessive perspiration and had increasing difficulty in walking because of muscular weakness. This was quickly followed by pains in the chest and abdomen and difficulty in talking, swallowing, and breathing. Cold water was swallowed with difficulty and gave a burning sensation to the tongue and throat. Within 3 hours, four patients exhibited carpopedal spasm, generalized muscular spasm associated with severe pains in the abdomen, chest, and legs, and went into shock.

Many patients had aphonia, and spastic paralysis of the arms and legs associated with coarse tremors. Others were unable to swallow liquids or solids and had dyspnea on exertion, associated with severe pain in the chest. The pain was constrictive and persistent, lasting from 3 to 5 hours, and resembled the distress of coronary thrombosis.

In about 4 hours, 50 percent of the patients had gone into shock of various degrees. A majority of the others had severe muscle spasm of the arms and legs, cold and clammy extremities, aphonia, and paralysis of the muscles of deglutition with marked difficulty in normal breathing. Ten patients exhibited bilateral palpebral ptosis. Fifteen patients complained of blurred vision, and one patient had temporary blindness of 2 hours' duration. One patient had right facial palsy for 2 hours.

The immediate treatment consisted of blood plasma, isotonic saline solution with 5-percent dextrose intravenously, external heat and bed rest. A few were given morphine and atropine, epinephrine, and oxygen. The patients in shock responded well to plasma therapy.

For 14 days all patients had residual symptoms of extreme weakness, dyspnea on exertion, and various degrees of pain in the chest, abdomen, and extremities, necessitating the use of codeine for relief. An unusual symptom for 5 days was the inability to drink cold water because of the burning and tingling sensation of the tongue. Many were unable to take cold showers for about 3 days, because of similar skin manifestations.

Bacteriologic examination of the fish at an Army hospital did not implicate any organism. The neurotoxin responsible affected the gastro-intestinal tract very little; during the episode there was very little nausea or vomiting and the appetite returned the following day

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even in the very ill. However six patients did vomit foul, fishy smelling material while being given their second 500 cc. of plasma.

There were three patients who exhibited delayed onset of the severe symptoms. Two medical officers felt increasing symptoms while supervising the treatment of patients but did not experience the serious symptoms until 9 hours after the meal. One other patient had a delay of severe symptoms for 9 hours and was the most serious shock case of the group.

The barracuda-like fish ingested was undoubtedly the culpable agent: (*a*) All who ate it were affected; (*b*) none at the mess who did not eat it were affected; (*c*) of each other food served, at least one person of the ill group had not partaken; (*d*) in the Korean Military Government camp several were affected by similar fish from the same catch, and they were the only others on the island eating the type of fish that day.

TABLE 1.—*Initial symptoms of 39 patients*

Symptoms	Number	Percentage
Weakness	35	89
Tingling of hands and feet	34	87
Burning sensation or tremors of mouth or lips	32	82
Diarrhea	31	79
Lassitude	29	74
Inability to swallow cold foods or liquids	26	66
Excessive perspiration	26	66
Muscular cramps of legs	24	60
Shock	21	53
Paralysis of muscle groups	21	53
Muscular cramps of arms	20	50
Nausea	20	50
Difficulty in breathing	17	43
Blindness or blurred vision	16	41
Abdominal cramps	16	41
Carpopedal spasm	14	36
Fever	13	33
Vomiting	12	30
Tics	8	19
Chills	6	15

TABLE 2.—*Residual symptoms in same group after 5 days*

Residual effects	Number	Percentage
Excessive weakness	20	50
Pain in legs	15	37
Itching feet and palms	11	27
Muscular cramps or lameness	11	27
Lassitude	8	20
Tingling in mouth and lips	7	18
Inability to drink cold liquids	7	18
Tingling in hands	6	15
Pain in eyes on reading	5	12
Headache	5	12
Pain in back	4	10
Tingling in feet	4	10
Chest and precordial pain	4	10
Palpitation of heart	2	5
Shortness of breath, fast pulse, nervousness, urinary incontinence, fever, nasal irritation	(*)	2

*1 each.

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EXPERIENCE AT CAMP SUSUPE, CIVILIAN INTERNEE CAMP, SAIPAN

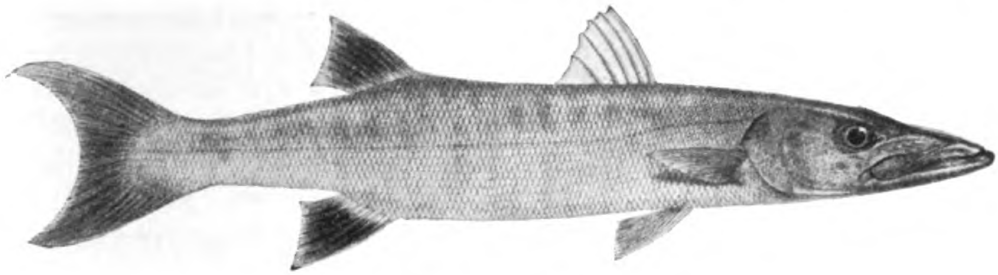
During the evening and night of 17 May 1945, a total of 10 civilian Koreans reported to the outpatient department of U. S. Naval Military Government Hospital No. 202 with symptoms and signs which were taken to be those of ordinary food poisoning. Five were admitted to the hospital, the remainder were given symptomatic treatment and returned to their quarters. None was considered seriously sick, even those who were admitted to the hospital being discharged 1 and 2 days later with a diagnosis of food intoxication. Subsequent review of these hospitalized cases revealed that one patient complained of numbness and tingling of the extremities.

The language barrier being what it was, it is not surprising that subjective neurologic symptoms if present would be missed, or would be disregarded as embellishment because of the tendency to exaggerate an illness. The whole thing was about to be considered a food poisoning of minor proportion; such were not of infrequent occurrence in the camp due to the impossibility of exercising supervision of individual food handling in a population of about 15,000 orientals whose food habits at best are not according to our standards. (For instance, it developed that in most instances this fish had been eaten raw.) When word was received of the serious outbreak described above, all known cases among the civilians were reviewed; in addition a few persons with delayed or prolonged symptoms appeared at the outpatient department subsequent to our being apprised of the above event. It was found that the same species of fish was eaten at the Korean camp as had been served at the officers' mess, except that the fish was smaller. It had been caught at approximately the same time, and at the same location. Only 1 such fish had gone into the civilian camp, and no food poisoning symptoms of any kind occurred elsewhere in the camp at that time.

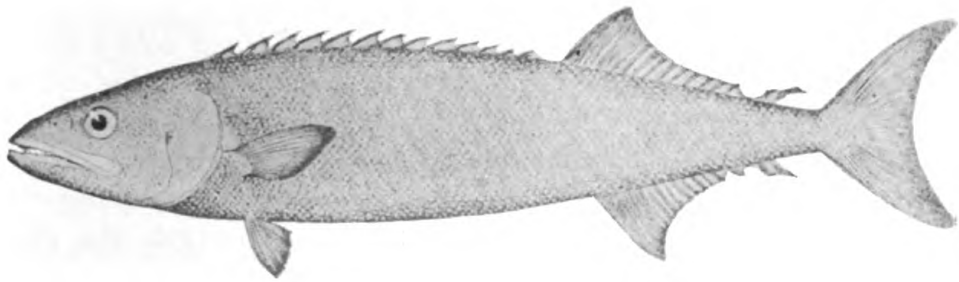
Thirty Koreans ate the fish at their evening meal, which was at 1730 (8 hours after the fish was caught). Symptoms began 4 or 5 hours later. The presenting symptoms were those of food poisoning of mild to moderate severity. A few patients who sought medical attention 1 to 3 days later complained of vague digestive symptoms and malaise. The Korean police chief, who because of his prominent position probably got a larger helping than the rest, complained of generalized numbness, a sense of weight on the chest, and a peculiar tingling sensation of the skin when bathing, continuing up to 72 hours after the meal, when the symptoms promptly disappeared. There were no motor paralyses and no objective findings of note in any of the cases.

The Japanese doctors in the outpatient department from time to time had suggested a diagnosis of fish poisoning in certain cases they had seen, but it was always rather vague as to whether they meant spoiled fish, ill effects of raw fish, or actual fish poisoning. Happily the

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1. Barracuda (Sphyraena).



2. Oil fish (Ruvettus pretiosus).

aid of an English-speaking civilian Japanese doctor who had made a special study of this subject throughout the Japanese mandated islands was secured. His study had been published in book form by the Japanese Navy, although no copy of it was available, all such material having disappeared at the time of assault on these islands. He was quite cooperative and sincere in assisting us, hampered, however, by the fact that he could remember only the Japanese names of the fish and by the fact that we had only one reference book available.[2] Although this makes no reference to poisonous or nonpoisonous attributes, the book is valuable in that practically all fish described therein are well illustrated, from which the Japanese doctor was able to identify the poisonous species for us.

About 300 species of poisonous fish have been recorded in the Marshalls, and about 200 species in the Marianas. In Japanese waters there is a poisonous fish called *fugu*, balloon fish, the poison of which exhibits an alkaloid-like action upon the nervous system. The group of symptoms it produces is called "fuguism," which begins with sensory paralysis or paresthesia of the mouth, lips, hands, and feet. In the more severe cases, motor paralysis occurs. The cause of death is cardiac or respiratory paralysis. If motor paralysis sets in a few minutes after eating, it is almost invariably fatal. Occasionally onset may be with vomiting and diarrhea, fuguism following. Motor paralysis first manifests itself by pupillary dilatation; the throat

[2] TINKER, S. W.: Director of the Waikiki Aquarium, University of Hawaii: Hawaiian Fishes: A Handbook of the Fishes Found Among the Islands of the Central Pacific Ocean. Tongg Publishing Co., Honolulu, T. H., 1944.

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muscles are next involved, causing difficulty in swallowing and speaking; the lower extremities are last involved. The temperature regulating center is affected. Early the reflexes are increased, later decreased. To a degree the symptoms and signs of all true fish poisoning, aside from stings and external irritants, are those of "fuguism," and without doubt the toxic element is the same. The Japanese have placed the over-all mortality from fish poisoning at from 2 to 3 percent.

They have not isolated or identified the toxic element, but it is interesting to note that they have made an extract of the liver or ovaries of the *fugu*, called fugutoxin or tetrodotoxin, which is used as an anodyne and antispasmodic. They have established uniformity of dosage, and indications for its use. There is variation in the concentration of the poison in different parts of the fish, the brain, liver, ovaries, and kidney containing the highest concentration, probably due to the richer blood supply. From feeding experiments with blood it was found that the blood was more toxic than the above tissues.

The poison appears to be highly water soluble. By thoroughly washing and soaking the tissues before using in feeding experiments, no ill effects were observed. Some Japanese even eat the carefully removed back muscles of the *fugu* after thoroughly washing. It is said to have a delicate flavor.

What produces the poison? The simplest explanation would be that the fish fed upon poisonous plant or animal life. However if this is so, why should not the fish itself be poisoned? Some of the poisonous species are wholly carnivorous. Intestinal contents of fish, these containing both animal and vegetable matter, have been fed to dogs and produced no symptoms of poisoning. It is fairly well established that certain species are poisonous only at certain seasons of the year and that the potency of the poison varies from time to time in those species which are always poisonous. The Japanese believe that the latter are most poisonous after spawning. When young, most poison species are only slightly poisonous, or not at all. These observations, coupled with the fact that the toxic element is most concentrated in the blood, have led to the theory that it is a hormonal product of the gonads or other ductless glands: however this does not explain why certain identical species of fish taken in some waters are poisonous, and in other waters not. Our informant pointed out that the Marshalls and Gilberts have the largest number of species of poisonous fish and that they are at approximately the same latitudes north and south of the equator, whereas Nauru and Ocean Island, more nearly athwart the equator, have no poisonous fish.

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TREATMENT

The stomach should be emptied by manual stimulation of the vomiting reflex in the throat, or by apomorphine. Water should not be given by mouth because of the water solubility of the toxic element, nor should gastric lavage be used because of the danger of leaving water in the stomach. For the same reason saline catharsis is advised against; instead a large dose of castor oil is given and repeated 2 or 3 times a day. Stimulants and intravenous fluids are administered. Because the temperature regulating center seems to be affected, careful attention is directed against any extremes of temperature change.

SUMMARY

A report has been presented of poisoning by fish used as food at an officers' mess and in a Military Government camp. The dramatic signs and symptoms observed have been tabulated and the treatment recorded.

Treatment consisted of blood plasma and 5-percent dextrose in saline intravenously for shock, preceded by castor oil purgation. The shock treatment was effective and recovery resulted in all cases. It was not determined whether plasma or intravenous saline was more effective. Calcium gluconate was administered without noticeable effect. The use of intravenous fluids and the limiting of fluids by mouth, because of the solubility of the toxin, seems to be the method of choice.

From the description supplied by the Japanese medical officer, there is little doubt that the fish in question was the well-known oil fish (Ruvettus pretiosus) widely known to have purgative qualities due to the oil content.—DR. LEONARD P. SCHULTZ, Curator of Fishes, U. S. National Museum.

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NOTES ON OUR RESERVE CONTRIBUTORS

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Bond, Frederick T., Captain (MC) USNR (*Suppression of Early Syphilis by Subtherapeutic Dosage of Penicillin*, p. 259). M. D., Syracuse University College of Medicine, 1929. Intern, 1929–31, clinical assistant urologist, 1931–33, assistant urologist, 1933–38, and associate urologist, 1938, Brooklyn Hospital, Brooklyn, N. Y.; clinical assistant in surgery, 1931–33, and assistant urologist, 1933, Kings County Hospital, Brooklyn, N. Y.; attending urologist, Victory Memorial Hospital, 1937, and Norwegian Lutheran Deaconesses' Home and Hospital, 1940, Brooklyn; private practice, Brooklyn. Fellow: New York Academy of Medicine and American Medical Association; member: Medical Society of the State of New York, Kings County Medical Society, and Kings County Urological Society. Diplomate American Board of Urology.

Carr, Lloyd G., Ensign H (S) USNR (*Action of Supernatants from Combined Growth of Fusarium Solani and Pseudomonas Aeruginosa against the Tubercle Bacillus*, p. 237). B. A., University of Virginia, 1940. Research, Mountain Lake Biological Station, University of Virginia, summers 1937–40; Thayer Scholar, Harvard University, 1941; research, department of bacteriology, Harvard Medical School, summer of 1941; Harrison Fellow in Botany, University of Pennsylvania, 1941–43. Member: Philadelphia Botanical Club and American Society of Plant Taxonomists.

Cohen, Samuel C., Lieutenant Commander (MC) USNR (*Poisoning by Barracuda-like Fish in the Marianas*, p. 311). A. B., Boston University, 1930; M. D., Boston University School of Medicine, 1935. Intern in medicine, 1935–37, and outpatient physician, 1938–, Boston City Hospital, Boston, Mass.; resident physician in tuberculosis, Boston Sanatorium (Boston City Hospital), 1937–39; assistant in medicine, Beth Israel Hospital, Boston, 1938–, and Boston University School of Medicine, 1940–; associate staff, Faulkner Hospital, Boston, 1938–; private practice, Boston, 1938–42. Fellow: American College of Chest Physicians and American Medical Association; member: Massachusetts Medical Society and American Trudeau Society.

Conaway, Horace B., Commander (MC) USNR (*Acute Infective Jaundice (Acute Hepatitis)*, p. 203). M. D., University of Pennsylvania School of Medicine, 1925. Intern, Philadelphia General Hospital, 1925–27; clinical assistant, department of metabolism, Graduate Hospital of the University of Pennsylvania, Philadelphia, 1927–28; chief, metabolic clinics, Philadelphia General Hospital, 1927–30; private practice, Philadelphia, 1928–; associate chief of medical service, Memorial Hospital, Philadelphia, 1930; assistant in cardiology, Hospital of the Woman's Medical College of Pennsylvania, Philadelphia, 1936–38. Fellow American Medical Association; member: Medical Society of the State of Pennsylvania and Philadelphia County Medical Society.

Crile, George, Jr., Commander (MC) USNR (*Exostosis of Sacrum; Report of a Case*, p. 269). M. D., Harvard Medical School, 1933. Fellow in surgery, 1934–36, and resident, July 1937–Nov. 1937, Cleveland Clinic Foundation Hospi-

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tal, Cleveland, O.; resident in gynecology, Roosevelt Hospital, New York City, Jan. 1937–June 1937; surgical staff, Cleveland Clinic, 1935–. Fellow: American College of Surgeons and American Medical Association; member: American Association for the Study of Goiter and Ohio State Medical Association. Diplomate: American Board of Surgery and National Board of Medical Examiners. Coauthor, Hospital Care of the Surgical Patient, Charles C Thomas, Springfield, Ill., 1942.

Danglade, James H., Commander (MC) USNR (*Asymptomatic Microfilariemia in the Caribbean Area*, p. 193). B. S. University of Kansas, 1924; M. D., University of Kansas School of Medicine, 1926. Intern, Bell Memorial Hospital, 1926–27; house officer, 1927–28, and assistant resident physician, 1928–29, Johns Hopkins Hospital, Baltimore, Md.; instructor in medicine, Johns Hopkins University School of Medicine, 1929–30, and University of Kansas School of Medicine, 1930–34; associate in medicine, University of Kansas School of Medicine. Fellow: American College of Physicians and American Medical Association; member: Kansas City Academy of Medicine, Kansas City Southwest Clinical Society, and Missouri State Medical Association. Diplomate American Board of Internal Medicine.

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Fitzgerald, Patrick J., Lieutenant (MC) USNR (*Asymptomatic Microfilariemia in the Caribbean Area*, p. 193). B. S., Massachusetts State College, 1936; M. D., Tufts College Medical School, 1940. Intern, Boston City Hospital, 1940–41; resident and assistant pathologist, Mallory Institute of Pathology, Boston City Hospital, 1942–43. Member Massachusetts Medical Society. Diplomate National Board of Medical Examiners.

Gillespie, Barnes, Lieutenant (MC) USNR (*Study of 100 Cases of Abdominal Pain in Service Women*, p. 179). B. S., Bethany College, 1933; M. D., University of Virginia Department of Medicine, 1937. Intern, Union Memorial Hospital, Baltimore, Md., 1937–39; resident in surgery, Peninsula General Hospital, Salisbury, Md., 1939–40; fellow in pathology, Northwestern University, and resident in pathology, Evanston Hospital, Evanston, Ill.; assistant surgeon,

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Hamrick, Wendell H., Lieutenant Commander (MC) USNR (*Suture of the Fingernail in Crushing Injuries*, p. 225). B. A., Rice Institute, 1929; M. D., University of Texas Medical Branch, 1934. Intern, Jefferson Davis Hospital, Houston, Tex., 1934–35; house physician, Memorial Hospital, Houston, 1935–36; private practice, Mt. Belvieu, Tex., 1936–37; project surgeon, Marshall Ford Dam, Tex., 1937–39; graduate studies in surgery, Medico-Chirurgical College, Graduate School of Medicine, University of Pennsylvania, 1939–40; resident in surgery, Southern Pacific Hospital, Houston, Tex., 1940–42; private practice, surgery, Houston, 1942. Fellow: American College of Surgeons and American Medical Association; member State Medical Association of Texas.

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Holford, William G., Jr., Commander (MC) USNR (*Treatment of Battle Casualties Resulting from a Dive-bombing Attack on an Essex-class Carrier*, p. 211). B. A., Stanford University, 1936; M. D., University of Oregon Medical School, 1939. Intern, Kings County Hospital, Brooklyn, N. Y., 1939–41. Member: American Medical Association, Medical Society of the State of New York, Medical Society of the County of Kings, and Aero Medical Association of the United States.

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King, Arthur N., Lieutenant, junior grade H (S) USNR (*Susceptibility of Serologically Typed Group A Streptococci to Penicillin*, p. 239). B. S., Montana State College, 1941. Teaching fellow, University of Washington, 1941–42; sanitarian, Washington State Department of Health, 1942–43; epidemiology, U. S. Naval Medical School, 1944. Member: Washington State Public Health Association, Washington State Sanitarians Association, and American Society of Bacteriologists.

Luedemann, Waldo S., Lieutenant Commander (MC) USNR (*Treatment of Battle Casualties Resulting from a Dive-bombing Attack on an Essex-class Carrier*, p. 211). B.S., University of Texas, 1927; M. D., University of Texas Medical Branch, 1931. Intern, 1931–32, and assistant resident in surgery, 1932–33, Charity Hospital, Cleveland, O.; private practice, San Antonio, Tex., 1933–43; staff, Nix Hospital, Santa Rosa Hospital, and Robert B. Green Memorial Hospital, San Antonio; chief, gynecology service, Robert B. Green Memorial Hospital 1942–43. Fellow: American College of Surgeons and American Medical Association; member: Medical Association of Texas and Bexar County Medical Society.

Newcomb, Alvah L., Commander (MC) USNR (*Meningococcemia with Waterhouse-Friderichsen Syndrome*, p. 273). B. S., University of Wisconsin, 1921; M. D., Rush Medical College, 1923. Intern, Evanston Hospital, Evanston, Ill., 1924; resident, Children's Memorial Hospital, Chicago, Ill.; associate physician, Evanston Hospital and Children's Memorial Hospital, Chicago; associate in pediatrics, Northwestern University Medical School. Fellow: American Medical Association, American Academy of Pediatrics, and American Diabetes Association; member Institute of Medicine of Chicago. Diplomate American Board of Pediatrics.

Pfanner, Eugene F., Commander (MC) USNR (*Coccidioidomycosis at U. S. M. C. Air Station*, p. 229). B. S., Denison University, 1921; M. D., Yale University School of Medicine, 1927. Intern, medicine, New Haven Hospital, New Haven, Conn., 1927–28; intern, assistant resident, and resident, surgery, Central Dispensary and Emergency Hospital, Washington, D. C., 1929–31; private practice, Dayton, O., 1932–42; surgical service, St. Elizabeth Hospital and Good Samaritan Hospital, Dayton. Fellow: American College of Surgeons and American Medical Association; member: Ohio State Medical Association and Montgomery County Medical Society. Diplomate National Board of Medical Examiners.

Rathmell, Thomas K., Commander (MC) USNR (*Arsenical Poisoning*, p. 305). A. B., Swarthmore College, 1927; M. D., Jefferson Medical College of Philadelphia, 1931. Resident physician, Philadelphia General Hospital, 1933; research fellow, Jefferson Medical College of Philadelphia, 1935; pathologist, Norristown State Hospital, Norristown, Pa., 1940; pathologist, Christian H.

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Buhl Hospital, Sharon, Pa., 1941, and Guantanamo Bay, Cuba, 1942. Fellow: American Medical Association and American Society of Clinical Pathologists. Diplomate American Board of Pathology.

Shaul, John F., Lieutenant Commander (MC) USNR (*Acute Infective Jaundice (Acute Hepatitis)*, p. 203). B. S., Lafayette College, 1930; M. D., New York Medical College, Flower and Fifth Avenue Hospitals, 1935. Intern, Essex County Hospital for Contagious Diseases, Belleville, N. J., July 1935–January 1936; Newark City Hospital, Newark, N. J., 1936–38; Children's Hospital, Washington, D. C., 1938–39; children's medical service, Bellevue Hospital, New York City, January 1938–July 1939; associate pediatric consultant, Newark Eye and Ear Infirmary, Newark, N. J.; assistant attending pediatrician, Mountainside Hospital, Montclair, N. J.; assistant pediatrician, Hospital of St. Barnabas and for Women and Children, Newark, N. J.; clinical assistant visiting physician, children's medical service, Bellevue Hospital, New York City; private practice, Bloomfield, N. J., 1940–. Fellow: American Academy of Pediatrics and American Medical Association; member: Medical Society of New Jersey and Essex County Medical Society. Diplomate American Board of Pediatrics.

Spealman, Clair R., Lieutenant H (S) USNR (*Protection of Feet Immersed in Cold Water*, p. 169). B. S., 1932, M. A., 1933, and Ph. D., 1936, University of California. Instructor, St. Louis University School of Medicine, 1936–37; associate, 1937–41, and assistant professor, 1941–, Medical College of Virginia. Member: American Physiological Society, American Association for the Advancement of Science, American Association of University Professors, Society for Experimental Biology and Medicine, and Virginia Academy of Science.

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Vincent, Harry B., Lieutenant Commander (DC) USNR (*Mercuric Cyanide in Treatment of Periodontal Disease*, p. 265). D. D. S., The Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania, 1929. Private practice, New York City, 1929–. Fellow New York Academy of Dentistry; member: First District Dental Society, New York, New York Dental Society, and American Dental Association.

Watkins, George L., Lieutenant (MC) USNR (*Adjustable Back Rest for Field Hospital Cot*, p. 296). A. B., Westminster College, 1938; M. D., Washington University School of Medicine, St. Louis, 1942. Intern, St. Louis City Hospital, St. Louis, Mo., June 1942–April 1943.

Webster, Earle H., Lieutenant Commander (MC) USNR (*Filariasis among White Immigrants in Samoa*, p. 186). A. B., Harvard College, 1936; M. D. Harvard Medical School, 1940. Intern, Hartford Hospital, Hartford, Conn., July 1940–June 1942.

Wilkins, Walter L., Lieutenant Commander H (S) USNR (*Mental Health of Men Discharged under the Point System*, p. 255). Ph. B., Loyola University, 1928; Ph. D., Northwestern University, 1933. Member American Psychological Association.

Woodward, Lewis K., Jr., Lieutenant Commander (MC) USNR (*Electric Ophthalmia*, p. 247). A. B., Western Maryland College, 1927; M. D., University of Maryland School of Medicine and College of Physicians and Surgeons, 1935. Surgeon, Front Royal Hospital, Front Royal, Va. Fellow: American Medical Association and American College of Surgeons.

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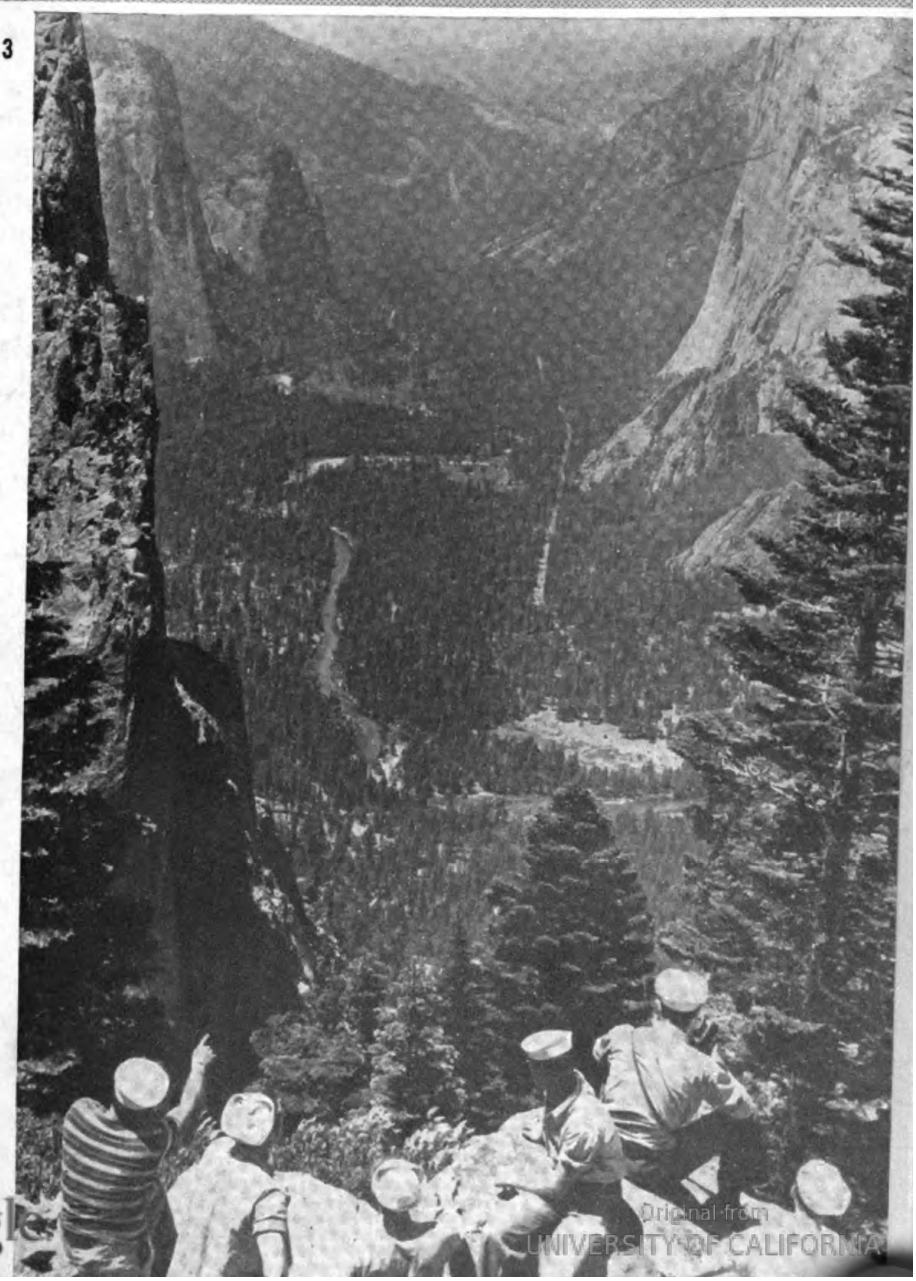
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46 NUMBER 3



MARCH 1946

BUREAU OF
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NAVY DEPARTMENT
WASHINGTON, D. C.

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COVER PHOTOGRAPH

Fortunate indeed were the patients who convalesced at the U. S. Naval Special Hospital, Yosemite National Park, Calif., for panoramic views such as the one portrayed on the cover were within easy hiking distance of the hospital. These hikes, as well as a large range of other sports and recreational activities, were a part of the hospital's therapeutic program.

—Official U. S. Navy Photo.

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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

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Volume 17, 1922, Nos. 4 and 6.
Volume 18, 1923, Nos. 1, 2, 3, and 5.
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Volume 20, 1924, Nos. 2, 5, and 6.
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PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

With the establishment of the Dental Corps in 1912, the function of the BULLETIN was broadened to serve in a similar capacity for members of that Corps.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

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NOTICE TO CONTRIBUTORS

Contributions to the BULLETIN should be typewritten, double-spaced, on plain paper and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication; for example, addresses and dates, not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in headings and captions.

Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustration, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized. Recognizable photographs of patients should carry with them permission to publish.

All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

ROBERT C. RANSDELL, *Editor*,
Commander, Medical Corps,
United States Naval Reserve, Retired.

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U. S. NAVAL MEDICAL BULLETIN

VOL. 46 MARCH 1946 NO. 3

SPECIAL ARTICLES

TRAUMATIC LESIONS OF PERIPHERAL NERVES

EXPERIENCE IN SOUTH PACIFIC AREA[1]

O. HUGH FULCHER
Captain (MC) U. S. N. R.

The purpose of this report is to record some observations made on patients who were suffering with traumatic paralysis of one or more peripheral nerves and to present some of the problems encountered. The author was attached for 9 months during 1943 to a medical unit that established a hospital in an advance South Pacific area. Patients were admitted from 18 hours to 3 days following injury and evacuated to a hospital in a rear area as soon as their physical condition and transportation facilities would permit. No effort to repair severed peripheral nerves could be made, but many wounds were inspected, excised, or dressed, at which time the anatomic state of any nerve or nerves involved could frequently be observed, described, and later corroborated by the findings obtained upon neurologic studies.

During 1944 the writer was attached to a hospital in the rear area where the maximum period of hospitalization was 120 days. Patients were evacuated to this location from hospitals in advance areas; others were received from hospital ships and transports. Their injuries had occurred from 7 to 40 days prior to local admission. This experience represented principally a selected study of patients during a later stage of convalescence to that observed in the forward hospital during 1943.

There were always many local accidents in both places which produced wounds similar in cause and nature to those inflicted by the enemy. Thus patients were treated from 1 hour to 5 months following the time of injury. It was not possible to study any individual during his entire treatment for peripheral nerve palsy because of the

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time limit of hospitalization. Adequate records for investigative purposes could not be kept because of the vast amount of work and the terrific heat at the first location, but some effort at a scientific approach to the problems was made. As a result of this experience, certain impressions were evolved regarding the treatment of traumatic peripheral nerve palsies and will be discussed as follows. It is not the purpose to discuss the treatment of wounds or of the general condition of the patient except as related to the handling of the nerve lesion.

1. *No effort should have been made to suture recently severed nerves in the combat area. The soft tissue wounds should have been lightly packed with gauze after hemostasis, cleansing, and dusting with sulfanilamide powder.* Most of the wounds had been treated at the site of combat by local application of sulfanilamide powder and light packing after hemostasis was effected. In these instances no attempt to treat the involved nerves had been made. Occasionally one saw wounds that had been sutured and the nerves had been repaired during the first 24 hours following injury. It was almost invariably necessary to remove the sutures of these wounds immediately upon admission of the patient, because of infection and the ever threatening danger of the presence of gas- and tetanus-producing organisms. Even if these wounds had healed, frequently a draining sinus with dirty granulations developed and persisted until the nonabsorbable sutures, that had been used to repair the nerve, appeared on the surface or until they were removed by exploration. The same results were seen on those patients whose recent wounds had been similarly treated aboard combat transports. When a sutured nerve became infected, there was evidence of destruction of the epineurium adjacent to the plane of repair which diminished the length of each epineural segment, thereby increasing the separation of normal neurofibrils. Any procedure that caused a shortening of the nerve segments proved to be particularly undesirable because of the difficulty encountered in apposing the severed ends.

All wounds that were received in combat in the South Pacific area were highly contaminated. This contamination was enhanced by the jungle, heat, lack of water, mud, rain, and insects.

2. *The anatomic continuity of a nerve trunk did not always indicate normal function.* When the packing was removed from wounds of the extremities, or when the wound was excised, a careful inspection was made for the nerves that might be involved and their status was recorded. Often severe pain and hyperesthesia along the distribution of a nerve resulted from gauze packed against the exposed trunk. On the other hand, inspection often revealed the nerve trunk to be intact but neurologic studies demonstrated a complete loss of function.

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and the paralysis of the nerve persisted, contrary to expectation. It was thought at first that the physiologic block was due to edema and would, therefore, be temporary. Re-exploration of the nerve trunk upon several occasions confirmed the observations made on the open wound.

This knowledge of the anatomic state of the involved nerves, which could frequently be acquired by studying the site of injury, was of prime importance regarding therapy. When there was continuity of the neural structures, no subsequent exploration had to be considered for a plastic procedure. If the nerve was partly or completely severed, re-exploration was considered in order to attempt to effect a repair. Those wounds that were associated with a loss of the nerve trunk, to the extent that apposition of the severed ends was impossible, were so designated so that any futile attempt to re-establish continuity was avoided.

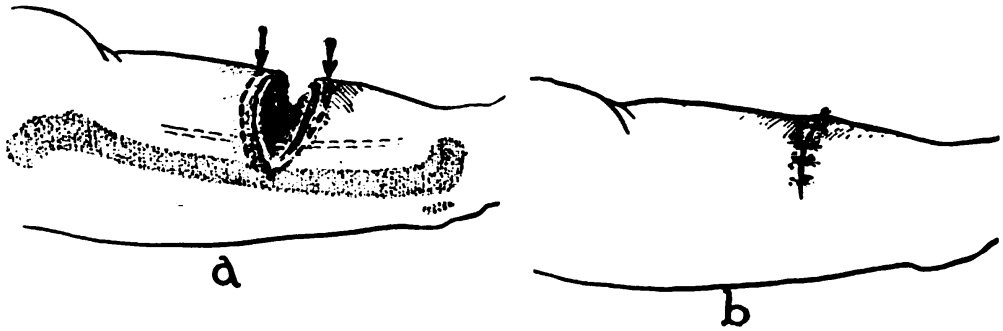
3. *Wounds which reveal an intact nerve trunk should not be allowed to heal by granulating tissue but, if possible, should be treated by excision and secondary closure to minimize the production of scar tissue.* It was soon observed that if an open wound with an exposed nerve trunk was permitted to heal by second intention, untoward symptoms frequently developed. In this event the patient complained of sharp shooting pains radiating over the distribution of the nerve. The pain was accentuated by pressure over the scar or by making traction on the scar in various planes. Patchy regions of hyperesthesia and hypoesthesia developed over the area of cutaneous distribution. The respective innervated muscles became weak and tonus was diminished; the involved superficial reflex diminished or disappeared entirely.

Exploration revealed usually that the nerve trunk had become constricted by the fibrous tissue essential for healing of the wound. Excision of the fibrous constriction did not always completely restore the function of the nerve. Later, similar wounds were treated, if possible, by excision and secondary closure, resulting in fewer untoward sequelae and more comfort to the patient during convalescence. No attempt was made to suture a nerve during wound excision or secondary closure (fig. 1A and B).

Many wounds were too large to permit a closure. If healing by granulation was permitted, the nerve trunk or trunks were frequently incorporated in the granulating tissue, resulting in constriction and stimulation, thus evoking pain over the distribution. The ensuing discomfort was frequently constant and severe enough to dominate the clinical picture.

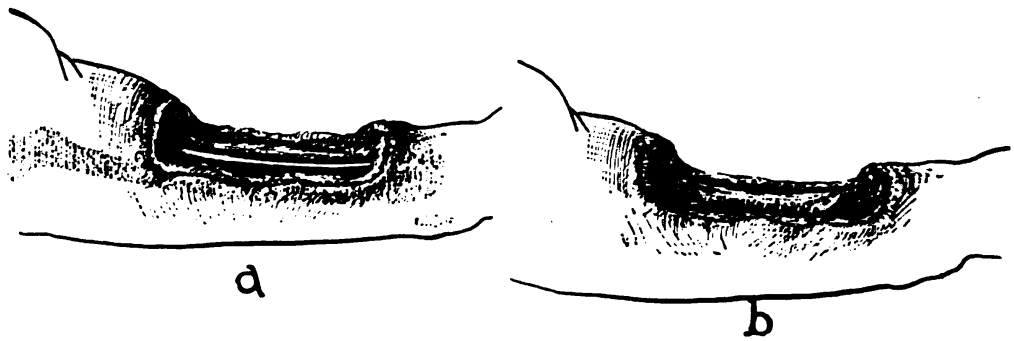
A case in point was that of a Marine who was admitted to the hospital about 6 weeks after an injury which had produced a large soft tissue defect of the middle half of the posterior portion of the

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1. A. Open wound revealing nerve trunk. Dotted lines represent approximate area excised. B. Secondary closure completed.

right thigh. The artery, nerve, and femur were exposed but were intact. Healing was occurring by granulation. As it progressed the sciatic nerve was incorporated and later was constricted when the usual contraction of the fibrous tissue developed. The excitation thus produced resulted in severe constant pain and hyperesthesia along the cutaneous distribution. The patient was unable to sleep, became nervous, irritable, and lost his appetite. Finally he requested morphine repeatedly. It was possible to evacuate him to the States but the problem of affording relief remained. Exploration to relieve constriction could not have been safely performed until epithelization of the wound had occurred.



2. A. Large wound revealing intact nerve trunk. Secondary closure not possible. B. Nerve trunk protected by muscle, fascia, or skin flap. Later wound may be skin-grafted or treated as indicated.

Similar wounds were treated subsequently by devising various methods of preventing the incorporation of the exposed nerve by granulating tissue. The wounds were excised and the exposed nerves were covered by muscles, by fascia, or by adjacent skin flaps. The skin flaps may be sutured to muscle or to fascia. After the nerve had been covered by some normal structure, the wound was treated as indicated (fig. 2A and B). If the nerve trunk could not be covered by any remaining tissue, a homologous split-thickness skin graft was applied. Brief observations following these procedures indicated that convalescence of the patient had been made more comfortable and the nerve had more completely retained its normal function.

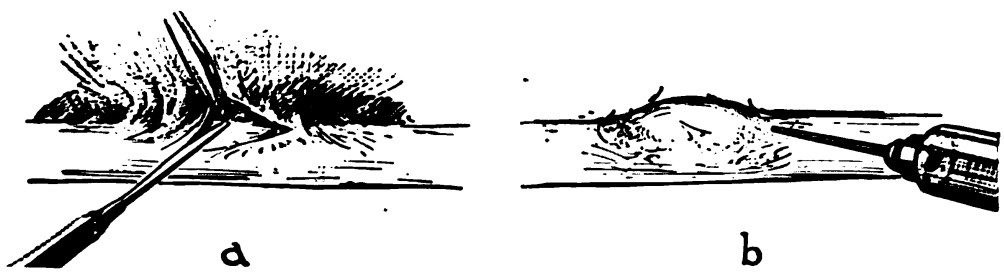
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4. *The anatomic status of the nerve could not be determined by neurologic examination.* A nerve trunk suspected of a traumatic lesion was therefore explored as early as surgical judgment permitted. At the time of admission, the majority of the patients did not have large open wounds which would afford opportunity to determine the anatomic status of the nerve by inspection. It was therefore necessary to attempt to estimate the extent of the traumatic lesion by neurologic studies. If the symptoms and signs of paralysis of a nerve remained constant during the healing of the associated wound and persisted without alteration for 2 weeks after epithelization had been completed, the nerve was explored. These explorations were most illuminating and the various findings were recorded as follows:

1. The nerve trunk was completely intact and the fibrous tract representing the course of the projectile did not involve the nerve in any way. During the early experience when the nerve trunk was not involved at the suspected level, it was still thought that an anatomic lesion must exist and explorations at other levels were occasionally performed. These explorations usually revealed an intact nerve trunk of normal size and appearance. Nothing could, therefore, be done to the trunk, and the wound was closed with the expectation that physiologic function of the nerve would return rapidly. It did not, however, do so. It was then thought that the palsy must have a psychic basis, so the patients were referred for psychiatric studies, but in almost every instance no psychiatric pattern could be elicited. During the observations that were made following exploration, there was no evidence to indicate that the function of the nerve was returning any more rapidly than if the nerve had been severed and an end-to-end anastomosis had been performed.

It is not understood why there should have been any paralysis of these nerves; it is even more puzzling why the paralysis should have persisted so obstinately. No nerve thus affected was observed to regain normal function during the limited period of hospitalization.

2. The epineurium of the nerve was intact but was adherent to the fibrous tract produced by the projectile. In these cases the fibrous tissue was excised and normal saline solution was injected into the

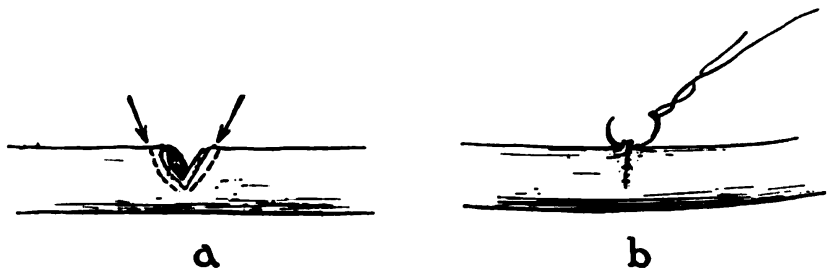


3. **A.** Fibrous tissue attached to epineurium being excised. **B.** Normal saline solution injected to determine the presence of any compression.

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nerve trunk to determine the presence of compression (fig. 3B). If by this method or by palpation, there appeared to be some fibrosis beneath the epineurium, the fibrosis was excised by a wedge-shaped incision and the epineurium repaired by interrupted No. 0000 nylon sutures. The function of the nerve following this treatment appeared to return very slowly.

3. The nerve trunk was partly severed, varying in extent from a mild nick to a degree where only a bridge of epineurium remained. All the nerve trunks that had this type of lesion were treated by wedge-shaped excisions of the fibrous tissue until normal neurofibrils were visible and the defect was repaired by appropriate sutures placed in the epineural sheath (fig. 4A and B). Thus the bridge of epineurium was saved to aid in preserving alinement. In no instance were normal neurofibrils severed if it was at all avoidable.

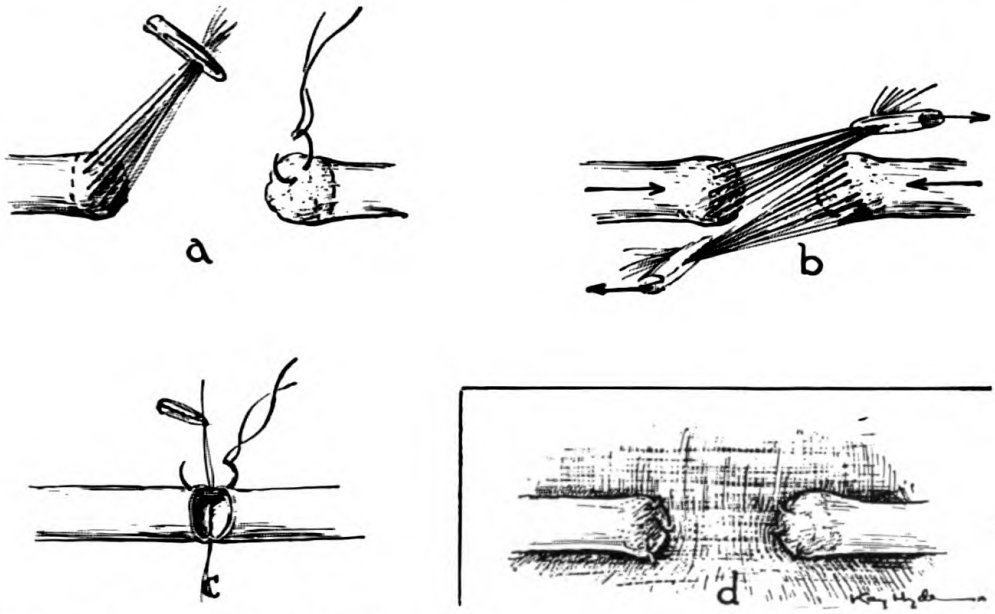


4. A. Nerve trunk partly severed. Fibrous tissue excised resulting in wedge-shaped defect. B. Defect repaired by suturing epineurium. Intact neurofibrils preserved.

4. The nerve trunks were completely severed, and the enlarged fibrous ends were frequently separated by intervening fibrous tissue representing the healed wound. In such cases all the fibrous tissue was excised until healthy muscle was adjacent to the proposed site of anastomosis. Each nerve trunk was dissected free of all fibrous tissue. This procedure frequently permitted elongation and often disclosed the presence of fibrous bands constricting the nerve trunk, which might preclude the regeneration of the nerve unless they were eliminated. The position of the extremity was adjusted to shorten the course of the nerve.

If the ends could be approximated easily, the enlarged fibrous stump of each segment was excised until normal neurofibrils were visible. Then, by observing similar nerve bundles in the cut ends, the segments were alined and held secure by stay sutures. Multiple interrupted No. 0000 nylon sutures were inserted through the epineurium, resulting in slight eversion at the suture line. The adequacy of the sutures was tested by injecting normal saline solution into the distal nerve trunk just below the plane of repair. If the saline leaked out, a more adequate repair was effected. Also it was thought that the presence

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5. **A.** Silk sutures placed in enlarged fibrous ends of nerve for traction. These ends must be excised later until normal neurofibrils are visible. **B.** Traction transmitted to nerve segments to produce elongation. **C.** Enlarged fibrous ends of nerve excised, segments alined by nerve bundles, secured by stay sutures, and epineurium anastomosed. **D.** Ends of nerves could not be apposed; they were sutured to intermuscular fascia to permit gradual elongation.

of saline solution in this location might prevent the formation of a blood clot.

If the ends could not be apposed after dissecting the trunk of each segment free of fibrous tissue and after making the course of the nerve as short as possible, sutures were placed in the enlarged fibrous ends and gentle traction was applied to elongate each segment. In this manner a repair could sometimes be effected as described. If apposition was still impossible, the ends were sutured to the intermuscular septum of fascia so that gradual elongation could occur. Nerve grafting and splicing were not attempted. The extremity involved was always immobilized by a plaster splint for a period of from 4 to 6 weeks (fig. 5A, B, C, D).

The wounds involving the brachial plexus were fairly numerous. If the wound had resulted from a rifle bullet, the patient often gave the history of becoming paralyzed over the entire body. During the following 24 to 72 hours the numbness and paralysis became localized to the upper extremity involved. The cause of this generalized numbness and paralysis was not demonstrated, but it did not appear when the wound of the brachial plexus had been produced by a large shell fragment. The symptoms and signs resulting from wounds in the lower lateral or anterior cervical regions were frequently bizarre.

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Two patients who had rather small wounds in the lateral cervical region complained so intensely of pain along the distribution of the entire brachial plexus that exploration was done before the wounds had completely healed. In each case x-ray studies had revealed the approximate location of small foreign bodies. A small shell fragment was removed from the fifth intervertebral foramen in one patient and from the seventh intervertebral foramen in the other. The respective nerve roots were contused and partly severed. Relief of pain ensued rapidly in each case.

In two cases the signs and symptoms indicated a complete loss of function of the brachial plexus. Exploration in one case disclosed the entire plexus to be normal in appearance. In another instance fibrous tissue had involved the nerve trunks which were edematous and injected but there was anatomic continuity. In two other patients exploration revealed the anticipated anatomic disturbance, with the exception that a partly severed trunk presented evidence of complete paralysis. The opportunity did not present itself to explore the sacral plexus as the concomitant injuries to adjacent viscera were paramount in the patients encountered.

5. *The development of constant, boring pain involving the cutaneous distribution of a severed or partly severed nerve indicated the presence of a compressed neuroma.* In these cases the patients frequently developed severe pain over the cutaneous distribution of a nerve during healing of the soft tissue wound. This symptom sometimes was so severe that it demanded prime consideration, as illustrated by the following case.

Case report.—A Marine sustained a large through-and-through wound of the left thigh in a lateral direction. Symptoms and signs of paralysis of the left sciatic nerve immediately ensued. Upon admission the wound was inspected, and removal of the gauze pack produced severe pain of brief duration over the distribution of the sciatic nerve. He was comfortable for about 3 weeks when he began to suffer with constant, boring pain of the left foot and the lateral aspect of the left leg. Application of heat did not afford relief. There appeared to be hyperesthesia to light touch over the distribution of the involved nerve although this area had previously been analgesic. The patient therefore improvised a cradle to keep the weight of the sheet off the foot, but the discomfort increased to the extent that administration of morphine was occasionally required.

Exploration was performed and revealed complete severance of the left sciatic nerve about 4 cm. below the inferior border of the pyriformis muscle. The end of the proximal segment of this nerve had a large neuroma embedded in dense fibrous tissue at the posterior border of the femur. The end of the distal segment was attached to the skin. The enlarged fibrous ends were excised until normal neurofibrils were visible, an end-to-end anastomosis was performed, and a plaster splint applied with the leg flexed and the foot in a plantar flexed position. The patient became comfortable almost immediately following this procedure and the area of cutaneous distribution of the nerve again became anesthetic.

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This phenomenon was observed several times but in lesser degree and was always relieved after excision of a compressed neuroma. It appeared that the presence of a neuroma alone did not produce this clinical picture unless the tumor was compressed. If this syndrome appeared over the distribution of a repaired nerve, it was considered sufficient indication to warrant exploration for a compressed neuroma at the site of anastomosis. A wedge-shaped excision of the neuroma and a plastic procedure could be performed on the epineurium to effect a more successful regeneration of the nerve and to afford comfort to the patient.

6. *Nerve lesions associated with wounds 6 cm. in diameter or less were explored 2 weeks following complete epithelization without precipitating infection.* Only the nerve lesions associated with wounds of this size could be explored, as the larger wounds required a longer time to heal than the maximum hospitalization period permitted. It was not known at first just what minimum time should elapse after complete epithelization of a wound before exploration of a nerve was permissible. During the earlier experience a period of 6 weeks was chosen but this time was gradually shortened without untoward results until 2 weeks was the period adopted. The patient was always given 1 gm. of sulfadiazine every 6 hours for 1 day prior to exploration of the nerve; this dosage was continued for 5 days following the surgical procedure.

The skin was shaved on the morning of surgery. In the operating room the area was washed with green soap and water and cleansed with ether; a coat of merthiolate was applied, permitted to dry, removed with 70-percent alcohol, and reapplied. Sulfanilamide was always dusted into the wound before closure with interrupted sutures of chromic No. 00 for fascia and cotton No. 60 for the skin. Interrupted No. 0000 nylon sutures were used for suturing the epineurium.

Local anesthesia produced by infiltration of 1-percent procaine hydrochloride was used on most patients except when the nerve was being handled, in which case sodium pentothal was given intravenously. Spinal anesthesia was used on some patients when the operation was performed on one of the sciatic nerves.

7. *Patients suffering with traumatic lesions of the peripheral nerves should be sent to special centers on the mainland for treatment.* The treatment of patients suffering with traumatic lesions of the peripheral nerves is a complex undertaking. It cannot be efficiently conducted if the patient represents just one of a group who must be expeditiously treated under adverse conditions. The surgeons should have time to make meticulous neurologic examinations and to record these findings, and adequately trained personnel should

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be available for the special care required. There should also be material and equipment for performing the plastic procedures, and there should be sufficient beds in the hospital so that the care during the prolonged convalescence may be given under the supervision of the same trained personnel until final disposition of the case.

The patient should have access to recreation and appropriate occupational therapy, and he should be able to see the members of his family and his friends. Prolonged hospitalization in a combat or precombat area is usually associated with deterioration of morale regardless of the primary illness. A perfect surgical result does not necessarily represent rehabilitation.

It is believed that transportation to a center on the mainland will not prolong convalescence in any way. There is invariably a soft tissue wound associated with the traumatic lesion of the nerve which can be appropriately treated en route. It is the author's opinion that the plastic operation should not be performed on the recently traumatized nerve acquired during combat, or for at least 2 weeks after the associated wound has been healed.

It should be stressed again that the same surgical team that performs the plastic operation should supervise the patient until final disposition is made. Otherwise the various surgeons can only obtain impressions of limited value. If these patients henceforth are sent to special centers, the treatment will be more effective, and sound policies regarding proper methods and procedures should evolve as a heritage for the medical officers of the future.

A NEW ANTIMALARIAL DRUG

Through the courtesy of Dr. J. Needham of the British Scientific Office in Chungking, samples of two indigenous plants regarded locally as of value in the treatment of malaria have been obtained and tested in experimental animals.

One of these, Fraxinus malacophylla, was found to be without action on Plasmodium gallinaceum in chicks. Contrary to the report of Liu et al., no alkaloid could be found in the bark.

The root of a second plant, known locally as *chang shan* and reputed to be Dichroa febrifuga, Lour., was ground and extracted with water and with dilute acid. Neither extract at a concentration where 1 cc. corresponded to 1 gm. of dry root gave the usual alkaloidal reactions, but both showed considerable activity against a trophozoite-induced infection of P. gallinaceum in chicks. The growth of exoerythrocytic forms was not prevented by the extract.—TONKIN, I. M., and WORK, T. S.: New antimalarial drug. Nature 156: 630, November 24, 1945.

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FRACTURES OF THE PATELLA

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and
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The patella is probably an integral part of the quadriceps extensor apparatus. The quadriceps femoris consists of the rectus femoris and the vastus medius, intermedius, and lateralis which all converge to form the quadriceps tendon. The quadriceps tendon passes over and around the patella and unites with the patellar ligament. Inferiorly it is inserted into the tibial tubercle. There are also lateral and medial expansions of the quadriceps tendon which insert into the medial and lateral condyles of the tibia. The superior and inferior margins of the patella are covered with fat.

The patella is an integral part of the skeleton, probably phylogenetically inherited, and its function probably plays no part in formation or growth. According to Brooke (*1*) and Dobbie and Ryerson (*2*), the patella has no important function in man, but is a morphologic remnant undergoing reduction and tending to disappear. The functional activity of the quadriceps muscle increases from birth, but the relative size of the patella becomes smaller. The patella has been modified to take part in the movements of the knee joint, but its presence is incidental and is a deterrent rather than an aid to movement. Experimental and other evidence shows that efficiency of the knee joint is increased after removal of the patella. It is also true that the patella is bulky and well developed in slow-moving animals such as the sloth, the bear, and the echidna, is very small in rapidly moving animals such as the fox and the antelope, and is completely absent in the kangaroo, which has an extremely well developed quadriceps muscle.

Brooke, Dobbie and Ryerson, and Key (*3*) are among those who believe that the patella is not really part of the extensor apparatus at all, but develops immediately behind the quadriceps tendon and operates by contiguity, more or less as a hindrance. On the other hand, Bruce and Walmsley (*4*), after careful embryonic studies of the development of the patella, came to the conclusion that it is an integral part of the quadriceps muscle, and an essential part of the extensor apparatus. Excision of the patella in rabbits almost invariably produced a particularly vicious type of chronic arthritis,

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with absorption of the articular cartilage and compact bone to expose the lamellae of spongy bone with intervening spaces. They believe that the protective function of the patella is most important, and that is why there is an attempt at partial replacement after removal.

METHODS OF TREATMENT

Until 1870, fractures of the patella were treated conservatively by splinting in extension, by elevation and massage of the limb, and by bed rest. Convalescence was prolonged and bony union rare, with resulting permanent disability. In 1877 Lord Lister and Sir Hector Cameron independently treated fractures of the patella by open reduction and wiring. In 1883 Lister presented seven cured cases before the London Clinical Society, but the procedure was generally condemned because of the ever-present danger in that era of sepsis, ankylosis, and amputation resulting from open operation upon the largest synovial cavity in the body.

Dennis, between 1883 and 1885, collected 137 cases treated by open reduction and wiring, and concluded that this was the method of choice. By 1900 the open operation was popular. Powers in 1898 was able to list 679 cases of open operation with manipulations, with only 3 deaths. Satisfactory results were obtained in 94 percent of cases. Heinecke in 1909 summarized 1,100 cases done during the 10 preceding years and found that the results were very satisfactory and the risk practically nil. In 1910 Corner summarized 504 cases of fractured patella treated at St. Thomas' Hospital in London. It was found that 85 percent of the fractures were transverse, 10 percent comminuted, and 1 percent compound; 65 percent of these cases had open operation. The patella is the most frequently refractured bone in the body. Ten percent of the cases refracture regardless of whether the treatment has been operative or nonoperative.

By 1910 open reduction was generally favored because: (1) Risk of death was largely eliminated; (2) bony union was usually obtained; and (3) more rapid repair occurred. The end results of open operation, however, are still not satisfactory, which can easily be surmised from the number and variety of operative procedures recommended. All authorities emphasize the importance of repairing the lateral expansions of the quadriceps extensor tendon, which is almost always damaged in transverse or comminuted fractures of the patella. Aside from that point, however, opinion differs widely as to the best method of treatment. Some authorities recommend immediate operation, others advocate waiting 12, 24, or 48 hours, 5 days, or even 10 days following the fracture. Some favor the use of a tourniquet. Some recommend a transverse incision, others a longitudinal incision.

The various methods of open reduction and fixation include: Exci-

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sion of patellar fragments, wholly or in part; suture with chromic catgut; suture with kangaroo tendon; suture with wire; immobilization with beef bone screws; transfixion with Kirschner wires and the use of plaster traction; suture with silk; plastic operation on the patellar tendon; fixation with Roger Anderson apparatus; inlay bone graft; insertion of Lane plate; and suture with fascia lata as recommended by Ghormley (*5*). Ghormley allows his patients to be up on crutches in 1 week and out of the cast and moving the knee in 1 month, and states that they have recovered completely in 6 months; whereas a repair with wire takes 1 year for complete recovery of function.

By any method of open reduction and fixation, there will be from 4 to 6 weeks' hospitalization, 6 months' limitation of activity, and after that considerable limitation of flexion. Because of this prolonged period of disability, excision of the patella, either totally or in part has attracted increasing attention in recent years. Chaput in 1891 excised the superior patellar fragment when flexion was impaired, and he also excised the patella, if in the process of repair it became too long and broad. In 1898 Stimson stated that removal of the patella does not impair the function of the knee joint. Hemeck in 1910 condemned excision of the patella on the basis of indifferent results in 13 cases, 5 of which were fractures. In 1935 Thomson (*6*) recommended removal of the small fragments in cases of fresh comminuted fractures, on the basis of 5 satisfactory cases.

Blodgett and Fairchild in 1936 (*7*) reported 55 reductions of patellar fractures, 35 of which were sutured, and 20 partial or complete excisions. Of the 15 cases sutured, which they were able to follow up, the results in 7 were excellent, 3 good, and 5 fair. Of the 7 partial excisions, 6 were excellent and 1 good. Of complete excisions, 1 was excellent and 3 good. In 1937 Brooke reported 30 cases of complete excision over a period of 7 years. He found that removal of the patella caused increased strength in resisting flexion from 1 to 5 pounds more than in the opposite leg. Convalescence occurred in 2 or 3 weeks, and the patients returned to work in 1 month. He recommends operation 48 hours after accident. In his technic the patella is shelled out and the quadriceps tendon repaired with silk or with a strip of fascia lata. He then applies cotton wadding and a firm bandage, has the patient walking in 2 days, and the bandage and sutures removed in 10 days.

Dobbie and Ryerson in 1942 reported 21 cases of patellar fracture followed by complete excision. One fracture was compound and two were refractures. Their indications for excision included any simple fracture with separation of fragments, and all compound fractures. The preoperative treatment was elevation and splinting in extension.

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Transverse or longitudinal incisions were used. The patellar fragments were everted with a towel clip, and the fragments were excised subperiosteally to preserve the overlying tendon. The tendinous expansions were repaired and then the central portion of the tendon. The type of suture material used was apparently immaterial. The patients were out of bed on the third or fourth day and walking with a cane. On the seventh to tenth days active flexion and extension exercises were carried out. By the second week the patients had complete extension and 90 degrees of flexion. Within 4 months there was no functional impairment. Sixteen of the 21 patients returned to their usual work. The power of extension was unimpaired and often greater than on the normal side.

Wass and Davies (*8*) in 1942 reported 8 cases of excision of the patella and felt that the end results were not satisfactory because of persistent pain, ungainly gait, and the ultimate development of painful arthritis. They recommended patellectomy only in cases of simple comminuted fractures with separation of the fragments, in compound fractures, and in cases of arthritis following nonunion.

Berkheiser (*9*) performed 11 patellectomies in cases of chronic hypertrophic arthritis and considered 8 of the patients to be definitely improved.

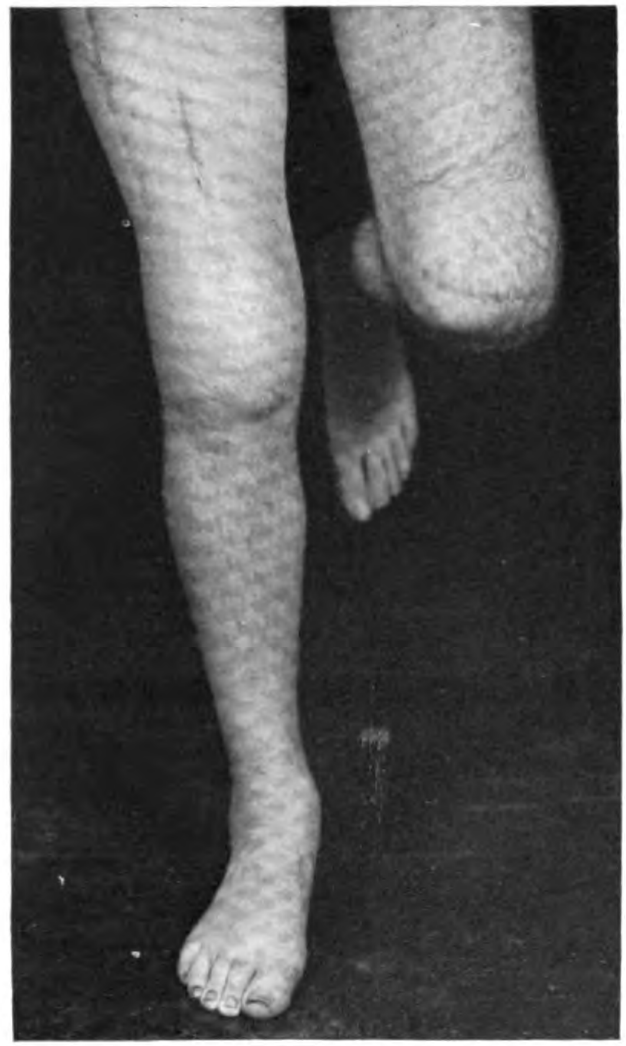
CASE REPORTS

On the surgical service at St. Albans Naval Hospital, New York, eight patellectomies were performed between 24 March and 31 November 1944. One was for chronic arthritis, two were on fresh fractures, and five were on old fractures. Of the five old fractures, two were compound and comminuted (gunshot wounds), two had had previous open reduction and fixation by wire sutures, and one was an old unrecognized longitudinal fracture.

Two results could be called perfect. One was the case of a 34-year-old gunner who suffered a comminuted fracture of the left patella and a simple fracture of the right femur when his ship was torpedoed in January 1944. On 21 March a patellectomy was performed through a transverse incision. Due to prolonged immobilization in a hip spica cast (because of his fractured femur), the patient developed an ankylosis of the right knee, and when he became ambulatory was forced to bear most of his weight upon his left leg. From about 10 weeks after patellectomy until he returned to duty in November 1944 he had complete function, complete range of motion, and almost normal contour of the left knee and leg (fig. 1). He had no pain in the knee and stated that his knee was as good in every respect as before the injury.

The other case was that of a veteran who had an old comminuted fracture of the patella with nonunion. Two months after patellec-

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1. Postoperative patellectomy in the left knee. Satisfactory range of flexion is demonstrated.

tomy he had perfect function and complete range of motion, and was able to return to a job involving heavy manual labor.

The result was classed as satisfactory in that the patient was able to return to work within 3 months. He had had a patellectomy performed on 17 July 1944 because of a comminuted fracture with separation of the fragments. However there was still some pain and limitation of motion at the time of discharge.

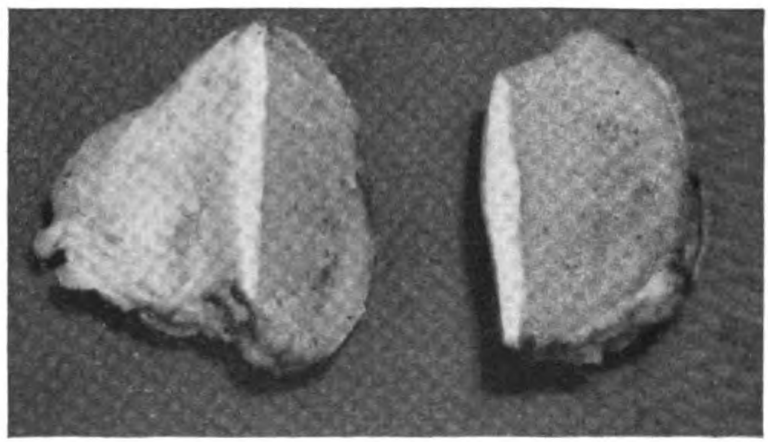
Four cases must be classed as unsatisfactory. These patients had patellectomy performed between 1 September and 27 September 1944. One case (fig. 2) was that of an unrecognized longitudinal fracture of the patella at least 4 years old. The anteroposterior diameter of the bone was thickened to such an extent that there was both a visible and palpable deformity, associated with some pain and inability to squat on the heels (limitation of complete flexion).

Two other unsatisfactory results (figs. 3 and 4) occurred in cases of old transverse fractures which had been wired after incomplete reduction with resultant over-riding of the articular surfaces. These patients both had pain and limitation of flexion of about 90 degrees. The fourth case was that of a badly comminuted fracture, the result of a gunshot wound incurred on Saipan on 22 June 1944, with some pain and limitation of flexion to about 80 degrees. This patient was able, however, to bear the full weight of his body on the involved leg with the knee flexed.

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The last patient in this group suffered a transverse fracture of the patella with separation of the fragments on 31 November 1944. A patellectomy was performed on the same day through a transverse incision, and he was up and walking within 2 weeks. One month later he had very little pain and had a range of motion from 175 to 160 degrees. Due to the fact that he was transferred to a plastic surgery ward to have revision of facial scars, he had not been receiving physiotherapy.

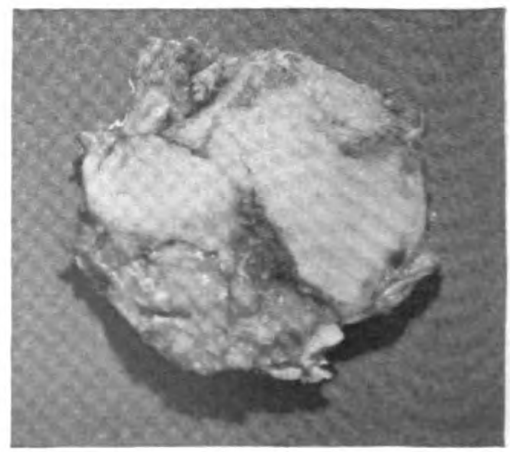
All of these patients still complained of pain in the knee 4 months



2. Patella removed with unsatisfactory result. Unrecognized longitudinal fracture with great thickening of bone from front to back.



3. (Left) Old fractured patella which had been wired.



4. (Right) Old transverse fracture of the patella, showing marked changes in the articular surface of the patella.

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following operation, had less range of motion than prior to operation, and had not returned to duty.

As for operative technic, it was found comparatively simple, in cases of long standing, to excise the patella through a median parapatellar incision, incising the quadriceps expansion along the medial border of the patella, and then shelling out the patella, using towel clips as bone-grasping instruments. The quadriceps expansion was then sutured with interrupted nylon or chromic catgut sutures, the skin with nylon sutures, and an Ace bandage was applied.

In recent fractures, a transverse incision was used to facilitate repair of the quadriceps expansion. In these cases a posterior molded splint was applied for from 7 to 10 days. The patients were allowed to be out of bed and bear weight on the leg upon removal of the skin sutures on the ninth or tenth day.

There has been no clinical or x-ray evidence of regeneration of the patella in this series, although experimental and clinical experience elsewhere indicates that attempts at regeneration do occur.

The postoperative rehabilitative regimen is of the utmost importance. Quadriceps muscle contraction exercises should be instituted on the third or fourth postoperative day. These should be supplemented by diathermy, massage, and bicycle riding on the tenth to fourteenth day. Active cooperation of the patient and the aid of a skilled physiotherapist is of tremendous importance. The four cases in which good results were not obtained were probably due, in part at least, to the lack of cooperation in the rehabilitation program.

CONCLUSIONS

On the basis of personal experience with eight cases of excision of the patella at the U. S. Naval Hosptal, St. Albans, and after a review of the literature, it is concluded that patellectomy is not a procedure to be undertaken lightly.

There is conflicting evidence as to the necessity for the presence of the patella as an integral part of the quadriceps extensor apparatus, but it seems reasonable to assume that the patella serves at least a protective function in guarding the articular surfaces of the femoral condyles. Despite enthusiastic reports to the contrary, in only two cases out of eight at this institution has there been anything like the return of function which one might be led to expect.

It is the belief of the authors that patellectomy is indicated in:

1. Fresh compound comminuted fractures.
2. Comminuted fractures.
3. Old fractures that have healed in malposition or have been incompletely reduced, leaving irregular articular surfaces and thus producing traumatic arthritis.

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4. Some cases of hypertrophic arthritis of the knee joint in which it is believed that the patella is causing a mechanical block and is a factor in the production of pain.

Patellectomy is a procedure which has been called radical and condemned by many authorities. However, the technic is simple, and if performed early and followed by the proper rehabilitative measures, it will yield gratifying results in carefully selected cases. It must not be used as a routine measure in the treatment of all fractures of the patella.

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EFFECT OF SPLENECTOMY ON PITUITARY AND ADRENALS

In the course of a study of the pituitary-adrenal reaction to stress, this response was found to be inhibited by splenectomy. It was also observed that spleen extracts contain an active substance which can reproduce the reaction to the original stimulus. This active substance was isolated and obtained in pure, crystalline form. It is probably part of the anti-enzyme system which protects proteins against trypsin. The spleen, as an endocrine organ, may therefore play a part in the control of protein metabolism and its adjustment to conditions of stress.—UNGAR, G.: Endocrine function of spleen and its participation in pituitary-adrenal response to stress. Endocrinology 37: 329–340, November 1945.

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CHEMICAL SYMPATHECTOMY IN NEUROVASCULAR LESIONS OF THE UPPER EXTREMITY

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Traumatic injuries of the upper extremities, involving the major arterial and nerve trunks, have two associated features too frequently underestimated or overlooked; vasomotor overactivity and inadequate collateral circulation. It is anatomically fortunate that cessation of the former and improvement in the latter may be obtained simultaneously by interruption of the appropriate sympathetic outflow to the particular extremity.

Although well recognized as a frequent limb-saving procedure in acute arterial vasospasm, and more recently brought into prominence in the surgical management of Sudeck's atrophy and the posttraumatic painful extremity (*1*) (*2*) (*3*), the role of sympathetic interruption in the pre- and post-operative management of the chronic phases of neurovascular injuries has not been sufficiently appreciated. This is more often encountered in the case of the upper extremity, perhaps due to the greater technical difficulties attendant on thoracic sympathetic block as contrasted to the lumbar injection. For this reason the technic and indications applicable to denervation of the arm are discussed, although both situations are essentially similar.

In seeking the most suitable method to obtain semipermanent sympathetic denervation of the upper extremity, Labat's technic of paravertebral block with procaine followed by alcohol, was found to be ideal from several standpoints when modified in minor respects. The patient was spared an operative procedure in addition to the one or more required in treating his primary disability. In avoiding rib resection attendant on surgical thoracic sympathectomy, prospects for return to duty were improved. The duration of action, which averaged 6 months to 1½ years, paralleled the period of recovery of the primary disability with considerable time leeway in most instances. Chemical destruction of the second and third thoracic ganglia and rami have yielded excellent results, and we have been unimpressed with the necessity of including the first thoracic outflow which will produce a Horner's syndrome.

Some remarks on the technical aspects of thoracic sympathetic block are in order at this point. Although the procedure is not essential in the everyday domain of the medical officer, its importance, both diag-

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nostically and therapeutically, in traumatic surgery has become such that it is expedient for each active shore station to detail the neurosurgeon or anesthetist to become familiar with the technic. The injection can be painful, shocking, and hazardous to the patient; or, with familiarization with the anatomic landmarks, be accomplished with as little reaction as the average soft-tissue block. In appraising results oscillometry and dermathermic records are not essential adjuncts, although they are helpful in providing objective data. In addition to acquaintance with the basic technic concisely set forth by White and Smithwick (*4*), the following points have been found helpful:

1. The patient should receive thorough premedication with a barbiturate, morphine, and atropine.

2. When properly placed the needles have uniform declination in the sagittal plane.

3. The erring injection is likely to be on the side of insufficient depth. The average depth in our experience has been 8.5 centimeters.

4. Gentle aspiration is done prior to each injection. Withdrawal of air or spinal fluid is sufficient reason to postpone a second attempt for several days. Minor realinement of the needle frequently will adjust a slightly bloody aspiration.

5. "Spotting" with 2 cc. of 1-percent procaine is first done. Sympathetic denervation should be evident within 20 minutes for alcohol to have the desired result. Five cubic centimeters of procaine is then added to each needle and an additional 15 minutes allowed for adequate anesthetic action prior to alcohol destruction. This dilution does not appear to affect the chemical action but is essential for avoidance of pain.

Chemical sympathectomy of the upper extremity has been used at this activity in two general categories of traumatic neuropathies and arterial injuries. In peripheral nerve injuries the annoying and often incapacitating vasomotor byproducts of hyperhidrosis, cyanosis, and causalgia are controlled. In arteriovenous fistula, false aneurysm, and compressive-spastic syndromes of the major arterial trunks the stimulus to collateral formation and the complete opening of preexisting collateral channels may swing the balance to a successful surgical result. Again in the postoperative period the circulatory and vasomotor status of the extremity becomes receptive to graduated physical therapy, unhampered by sympathetic overactivity and intermittent claudication. The following cases are illustrative:

CASE REPORTS

Case 1.—A Marine private received a gunshot wound of the left shoulder on 9 September 1944. There was immediate incomplete involvement of the ulnar and median nerves and the subsequent development of a pulsating left axillary

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mass within 7 weeks. On 25 November ligation of the left axillary artery for false aneurysm, and neurolysis of the involved nerve trunks were carried out. Postoperatively there was slow improvement in nerve deficit. The left hand remained cold and hyperhidrotic with a mottled erythema and cyanosis. Chemical thoracic sympathectomy was done on 30 December, with immediate cessation of sympathetic overactivity and return of the radial pulse. Graduated active exercises were then begun. At present ulnar function is almost complete and median return is progressing steadily. Circulatory status of the arm has been maintained.

Case 2.—A motor machinist's mate, third class, received a through-and-through machine-gun bullet wound of the left arm on 6 June 1944. The immediate wound healing was uneventful but 4 weeks later he noted the gradual onset of numbness, coldness, and pallor of the fingers of the left hand, and pain radiating down the arm. The examination showed marked diminution of the radial pulse with vasomotor overactivity and ischemic hyperesthesia of the fingertips. There was no neurologic evidence of any selective peripheral nerve deficit.

On 1 November the Leriche procedure (*5*) of periarterial stripping was carried out on the left brachial artery, although it was surmised that it might not suffice to control his symptoms. The arterial trunk was noted to be compressed and spastic with a diameter less than half the normal caliber. Postoperatively there was a moderate increase in radial pulsations with fluctuating vasomotor relief, which however soon returned to its former level. On 11 January 1945 chemical sympathetic denervation was done with complete relief. In this case the first thoracic ganglia and rami were blocked following routine denervation without appreciable effect on surface temperature. On 9 March he was returned to full duty.

Case 3.—A Marine private, first class, sustained a bullet wound on 10 October 1944 with entry in the left anterior chest wall 2 inches from the sternal border and exit on the lateral aspect of the right arm. There was immediate paralysis and loss of sensation of the right hand due to transection of the radial nerve and practically complete interruption of ulnar and median function. Four weeks later he noted the development of a pulsating mass in the right axilla. During the following month this gradually increased in size and the right hand became cold, cyanotic, and painful, with early trophic changes.

On 10 December preoperative chemical destruction of the second and third thoracic ganglia and rami was done. There was an excellent temperature response with a warm, pink, dry hand and slightly increased radial oscillations. Eight days later quadrilateral ligation and excision of an axillary arteriovenous aneurysm was carried out as well as radial anastomosis and neurolyses of the ulnar and median nerves. At no time in the postoperative course was there evidence of circulatory embarrassment; at present recovery of nerve function is proceeding at the anticipated rate.

Case 4.—A Marine private received a through-and-through machine-gun bullet wound of the right shoulder in November 1943. There was immediate evidence of partial brachial plexus injury and within 6 weeks a pulsating mass developed above the right clavicle. On 2 February 1944 ligation of the right subclavian artery for arterial aneurysm was done. During the following 8 months progressive recovery of nerve function took place and he was returned to duty. The right hand, however, remained cold and hyperhidrotic, and on maneuvers he developed increasing intermittent claudication of the arm on muscular activity, and cyanotic mottling when exposed to cold. He was returned to the

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sick list and on 6 January 1945 chemical sympathectomy was done. Vasomotor disturbances were entirely relieved and intensive physical therapy and exercise tolerance tests gave no subjective symptoms. He was returned to full duty on 2 February.

COMMENT

Case 1 was of interest in furnishing objective evidence of the opening of collateral channels in the restoration of the radial pulse. Prior to denervation, sympathetic overactivity and insufficient collateral circulation were sufficiently evident to interfere with physical therapy in improving muscle action of the hand and forearm.

Case 2 was a pure compressive-spastic syndrome of the brachial artery as the result of contiguous hemorrhage and organization. The Leriche operation improved the circulatory status of the extremity, but was insufficient from the sympathetic standpoint to give more than transient vasomotor relief, which necessitated autonomic interruption at a higher level.

In case 3 it is extremely dubious whether the surgical attack on this arteriovenous fistula and the requisite peripheral nerve repairs could have been accomplished concomitantly without risking the loss of the extremity, had sympathetic interruption not been carried out.

Case 4 illustrated inadequate collateral circulation postoperatively to the point where the extremity was entirely useless for 2- to 3-minute periods following muscular activity. Following chemical sympathectomy, sustained exercise elicited no evidence of intermittent claudication.

The subjective relief offered to this group of patients by the denervation is impressive and often strikingly improves their mental attitude. Because the abnormal color and temperature changes of the hand are a continual source of concern, the sweaty palm becomes as much a social detriment as a clerical hindrance; the fingertips are described as numb, stiff, puffy, or swollen. When increased active exercise is stressed by the medical officer it becomes synonymous with increased ischemic pain and hypesthesia to the patient. Return to duty is viewed with the misgivings of additional discomfort. Relief of these components is therefore advantageous not only to the local condition, but to total mental outlook and well-being of the patient.

It is not inferred that this denervation technic is invariably indicated in the field of neurovascular injuries of the extremities. When there is complete transection of a peripheral nerve, an accurate, well performed anastomosis is the indicated method to secure rapid cessation of vasomotor hyperactivity. Similarly there is no greater stimulus to collateral circulation in an extremity than the formation of an arteriovenous fistula.

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It is chiefly in those cases of traumatic neuropathy with partial interruption of function due to pressure, hemorrhage or scarring, that the denervation technic should be considered in conjunction with neurolysis. In arterial surgery which involves temporary or permanent major trunk ligation, although performed at the optimum time following injury and at the optimum level to avoid blind segments, this procedure rarely can be ignored when there is any doubt as to the circulatory integrity of the extremity. With proper selection of cases and familiarization with the technical details, chemical sympathectomy should be an important adjunct in the treatment of this group of neurovascular lesions.

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INHIBITORY ACTION OF SULFONAMIDES

In view of the fact that it has been shown that the cytochrome-cytochrome oxidase system is concerned in the synthesis of diiodotyrosine and thyroxine, a study was made to determine whether an interference with this enzyme system could account for the inhibitory effects of the sulfonamides and their derivatives and of thiourea and its derivatives upon the incorporation of inorganic iodide into diiodotyrosine and thyroxine by surviving thyroid slices.

No marked effect upon the oxygen consumption of surviving sheep-thyroid slices was observed when they were suspended in a Ringer medium containing the sulfonamides, or the p-amino aromatic acids, or thiourea, or thiouracil, or allylthiourea. It is therefore concluded that these compounds do not interfere with the cytochrome-cytochrome oxidase system in thyroid tissue—LERNER, A. R., and CHIAKOFF, I. L.: Influence of goitrogenic compounds (sulfonamides and their derivatives, thiourea and its derivatives) on respiration of thyroid tissue. Endocrinology 37: 363–368, November 1945.

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DIVING AT U. S. NAVAL TORPEDO STATION, NEWPORT, R. I.

WITH EMPHASIS ON CASES OF BENDS OCCURRING DURING 1944

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A history of this station contains the following brief statement regarding diving: "In 1882, a diver was employed for the purpose of instructing the officers' class. Diving was not compulsory and instruction was only given to such officers who desired it." This instructor was a civil service employee who had received his diving training as a gunner's mate in the U. S. Navy. He also taught diving at the Seaman Gunners School. Each man taking that course was qualified at 60 feet. Prior to 1918 all diving on torpedoes was done by civilians.

In 1916 the Navy's first deep-sea diving school was started at the Torpedo Station. Passed Assistant Surgeon George R. W. French (MC) U. S. N., who was the medical officer at that time, had studied deep-sea diving with the Royal British Navy and was our Navy's first diving medical officer. Four classes were graduated before the school was discontinued. The course lasted 4 months and was similar to the one offered today. In 1929, the equipment used at the first school was moved to Washington, D. C., and the present school was established.

The reason diving plays such a major role at this station is that the most efficacious means of retrieving torpedoes that have sunk on the testing ranges is with deep-sea divers.

Between 1 January 1944 and 1 January 1945 there were over 3,000 dives made to depths less than 90 feet. All dives were done in complete diving suits and no dives were of sufficient length of time to require decompression. There were no cases of bends in this series. During that same period there were approximately 900 dives of over 90 feet in depth, 860 of which required decompression. There are accurate records available on 822 of these dives from which the data in the accompanying table was taken.

There were 40 dives, or 4.6 percent, over the optimum time as indicated on the Standard Navy Decompression Table (SDT). All divers who required over 30 minutes' decompression were given surface de-

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Data on 822 dives

Total minutes from descent to end of decompression	Number of dives	Percent of total
15–60	16	1.95
60–90	75	9.12
90–120	106	12.89
120–150	506	61.55
150–180	89	10.82
180–210	14	1.70
210–273	16	1.95
Mean time, 144 minutes.		
Median time, 128 minutes.		
Feet per dive:		
90–100	48	5.9
100–120	380	46.3
120–140	394	47.9
Average depth, 115.6.		
Median depth, 120.		
Mean depth, 115.		

compression. This consists of raising the diver to a point 10 feet below the first stop required by the SDT for that particular dive and allowing him to remain at that depth for 5 minutes. Next he is raised to the level of his first required stop and decompressed for 10 minutes. This 15 minutes is spent on a stage that has been lowered from the diving boat. After the completion of the 10-minute stop, the stage is quickly raised to the deck where the diver's shoes, belt and helmet are removed and he is rushed into the chamber where full decompression required by the SDT is given. Decompressions that require only 30 minutes or less are done on the stage in the water. The many benefits of such a scheme are obvious, the drawbacks nil.

Conditions for diving at Newport are far from ideal. The only good factor is the type of bottom. It is composed of shells, sand, and gravel and is dense enough to prevent the diver's feet from sinking below the surface. It is also fairly smooth. The most adverse condition is the tide. The strongest tides are present in March and September. In the area where the deep dives are made the maximum tide during these months is 2 knots (about 200 feet per minute). Between these months the rate follows a smooth curve, with the lowest tides in June and December when it varies from 0.5 to 0.9 knot (from 50 to 90 feet per minute). The mean tide is just over 1 knot. Making circles against the tide is hard work in itself. Often the diver has hose out in lengths to exceed the actual depth of the dive by two or three times.

Water temperature also follows a uniform pattern. It is coldest in January and February when it stays about 31° F. The water is warmest in August when it reaches 71° F. The temperature fall from February to August is about 1° F. every 3 or 4 days and follows a smooth curve. The temperature of the air during the summer months makes tending topside very pleasant, but during the winter season most disagreeable. Visibility on the bottom is zero.

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NO.	DIVER	MONTH-1944	DEPTH-FEET	TIME ON BOTTOM —MIN—	DECOMPRESSION TABLE USED	SYMPTOMS	ONSET (INTERVAL FOLLOWING DECOMP)	TREATMENT	RECURRENCE	TREATED BY	COMMENT
1	A	MAY	103	52	110'-55 MIN	PAIN RT. SHOULDER	5 MIN	PAIN RELIEF AT 110' TAKEN TO 160' FOR 30 MIN. & OUT ON 150' A.T.T.	NO	DIVING PHM	
2	A	MAY	110	60	120'-65 "	PAIN RT. SHOULDER & ARM	3 HRS.	RELIEF AT 93' TAKEN TO 126' FOR 30 MIN & OUT ON 150' A.T.T	NO	"	INTERVAL BETWEEN DIVES ONLY 5 DAYS
3	B	MAY	122	55	130'-60 "	PAIN RT KNEE	22 HRS	TO 200' FOR 30 MIN & OUT ON 210' S.D.T. USING O_2 AT 60', 50', 40' STOPS	YES	DIVER	USED S.D.T. INSTEAD OF R.N. TABLE
							10 MIN	RELIEF AT 20' TAKEN TO 70' & OUT ON 210'-30 MIN S.D.T.	NO	"	
4	B	OCT.	93	60	110'-90 "	PAIN RT ELBOW	3 HRS	RELIEF AT 170' TAKEN TO 200' FOR 30 MIN & OUT ON A.T.T.	NO	MED OFF	MAN DIVED ON 2 CONSECUTIVE DAYS & DECOMP. TABLE NOT ADJUSTED ON 2ND DIVE. SYMPTOMS REPORTED 6 HOURS AFTER DIVE. NO RELIEF DEPTH GIVEN
5	C	JULY	122	45	130'-82 "	PAIN RT ARM	1 HR	RELIEF AT 63' TAKEN TO 100' FOR 30 MIN & OUT ON 100' A.T.T	NO	DIVING PHM	
6	C	SEPT	122	33	130'-35 "	PAIN RT KNEE	7 HRS	RELIEF AT 130' TAKEN TO 170' FOR 30 MIN & OUT ON S.D.T.	NO	DIVER	S.D.T. & NOT R.N. TABLE USED BUT NO RECURRENCE.
7	C	JUNE	118	55	120'-85 "	PAIN BOTH KNEES	8 HRS	TAKEN TO 120' FOR 30 MIN & OUT ON 150' A.T.T.	NO	"	RELIEF DEPTH NOT RECORDED
8	D	MAR.	108	57	110'-105 "	PAIN RT KNEE	6 HRS	RELIEF AT 100' HELD 30 MIN & OUT ON 100' A.T.T.	YES	DIVER	HELD AT RELIEF DEPTH. ONE ATMOS. EXCESS NOT ADDED
							½ HR	RELIEF AT 170' TAKEN TO 200' FOR 30 MIN & OUT ON 200' A.T.T.	YES	"	
							7 HRS	RELIEF AT 60' TAKEN TO 150' FOR 30 MIN & OUT ON 150' A.T.T. USING O_2 AT 60', 50', 40'	NO	PHM	
9	E	OCT	122	43	130'-45 "	PAIN RT SHOULDER	1 HR	TO 200' FOR 30 MIN WITHOUT RELIEF. TO 230' FOR 30 MIN & OUT ON 300' A.T.T.	YES	DIVER	DIVER ADMITTED RAPID ASCENT TO 1ST STOP. REASON PAIN NOT RELIEVED AT 200' PROBABLY DUE TO SHORT TIME AT 3RD STOP. REPORTED 18 HRS AFTER SYMPTOMS.
							AT 10 STOP	RELIEF AT 30' TAKEN TO 100' & OUT ON O_2 R.N. TABLE	NO	MED OFF	
10	E	AUG.	121	50	120'-82 "	PAIN RT. KNEE	5 HRS	RELIEF AT 145' TAKEN TO 180' FOR 30 MIN R.N. ON 200' S.D.T. TO 50' STOP & THEN OUT ON 200' A.T.T.	YES	DIVER	USED S.D.T. FOR FIRST STOPS.
							2 HRS	TO 120' FOR 30 MIN & OUT ON 200' ATT AFTER REGULAR 10' STOP GIVEN 1 HR. AT 8', 6', 4' & 2'.	NO	"	
11	F	APR.	102	50	110'-105 "	PAIN RT SHOULDER	2 HRS	RELIEF AT 110' TAKEN TO 143' FOR 30 MIN & OUT ON 150' A.T.T.	YES	"	
							AT 50 STOP	TAKEN TO 50' & OUT ON 200' A.T.T.	YES	"	NO RELIEF DEPTH GIVEN
							AT 10 STOP	TAKEN TO 20' & SLOWLY BROUGHT TO SURFACE	NO	"	NO TIME GIVEN
12	G	AUG.	—	—	—	—	—	RELIEF AT 160' TAKEN TO 200' FOR 30 MIN & OUT ON 150' A.T.T.	YES	"	DATA ON DIVE NOT GIVEN
							10 HRS	TO 200' & OUT ON 200' ATT WITH O_2 FOR 30 MIN. AT 60', 50', 40'	YES	"	
							30 MIN	5 HR. SOAK AT 10'	NO	"	
13	H	MAR.	138	54	140'-85 "	PAIN LEFT SHOULDER	3 HRS	RELIEF AT 130' HELD FOR 20 MIN & DECOMP. ON 130'-35 MIN. S.D.T.	YES	"	INITIAL R.N. ON S.D.T. ONE ATMOS. EXCESS OF RELIEF NOT ADDED
							1 HR	RELIEF AT 130', HELD FOR 30 MIN & OUT ON 150' A.T.T. WITH O_2 AT 60', 50', 40'	YES	"	ONE ATMOS. EXCESS NOT ADDED
							NONE	TO 170' & OUT ON 200' A.T.T.	YES	"	
							4 HRS	4 HR. SOAK AT 30' & OUT	NO	"	
14	H	JUNE	138	48	130'-82 "	PAIN RT SHOULDER	4 HRS	FIRST TWO ATTEMPTS AT R.N. DIVE ON S.D.T. HAD TO RECOMPRESS WITH VARIOUS TABLES. FINALLY CURED WITH SOAK. TOTAL R.T. TIME - 44 HRS.	YES	"	USED S.D.T. INSTEAD OF A.T.T. ON FIRST 2 ATTEMPTS

Data on 14 of the 16 cases of bends occurring in 1944.

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The actual work done in torpedo recovery is most difficult. Many torpedoes bury themselves under the bottom and have to be washed out. There is always present the mental strain associated with recovering tripping latch failures. The only death on this station as a result of diving was due to such a failure. The tide carried the diver's lines to a torpedo other than the one on which he was working and set it off. He was pulled into the propellers.

During the year there were 16 cases of bends, an incidence of 1.86 percent. Records on 14 of these cases are available for study and are presented in the accompanying chart. From this chart it may be concluded that in this series water temperature as low as 31° F. had no effect on the incidence of bends. During the three coldest months (December, January, and February) there were no cases. The relatively large number in April, May, and June may be attributed to the fact that the number of deep dives during that quarter had increased 300 percent over any previous 3-month period. The tide, likewise, had no effect on the incidence. There were more cases when the tide was lowest than when it was at its peak.

Assuming that the records are correct, the initial decompression in each case was adequate. Diver A's second case occurred only 5 days after his first attack and his symptoms were the same. Perhaps that case might have been averted if he had not been allowed to dive so soon after having had the bends. In another case (4B) the man dived on 2 consecutive days without any change in the second decompression time. Had the second decompression been longer, as suggested by the diving manual, he might not have been affected. The second dive was to finish a job he had started only 16 hours before, which required exact knowledge of what had been previously done.

One diver (9E) admitted blowing himself up to the first stop very rapidly. There was a practice at this station that the diver make himself light on the bottom to lessen the tender's work in raising him. It had progressed to the point where the diver blew himself to the surface and then kicked his chin button to get back to the first stop. The tender, meanwhile, gathered in the slack. Other cases may have been due to this departure from the 25-foot per minute ascent rule.

Of the 14 divers treated, 8 had at least 1 recurrence. Three had 1 recurrence, three had 2, one had 3, and one had 10. Four of the recurrences (3B, 10E, 13H, 14H) could be attributed to the fact that the SDT was used instead of the treatment table in initial attempts at therapy. In 2 cases treatment utilizing the SDT was successful; one was the initial attempt (6C), and one a first recurrence (3B). Recompression in two cases (8D and 13H) was inadequate. The patients were taken to relief but the additional atmosphere of pressure

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was not added. One case (9E) was not reported until 15 hours after the onset of symptoms. There were no apparent causes for the other two recurrences (11F and 12G). In none of the cases was proper treatment instituted after the original attempts had failed.

All six cases treated by the medical department (diving medical officer and diving pharmacist's mate) were successful on the first attempt. Four were previously untreated and two were recurrences. Of the 10 receiving initial treatment by other divers there were only 2 without recurrence. Treatment using pure oxygen breathing was not in vogue. Since there was no medical officer trained in diving present until October, the divers elected to treat themselves and for some reason, probably "old wives' tales" handed down by the older divers, had no faith in the new approved type of therapy.

At the present time all four recompression chambers are equipped with oxygen treatment facilities, and the practices of uncontrolled ascent and self-treatment have been stopped.

CONCLUSIONS

1. The low incidence of bends indicates that the Standard Navy Decompression Table in present use is adequate.

2. Water temperatures between 31° and 72° F., and tides as fast as 2 knots (200 feet per minute) have no effect on the incidence of bends.

3. The large number of recurrences in this series is considered to be due for the most part to incorrect initial treatment.

4. Recurrent cases should receive prolonged treatment (soaks) to prevent further recurrences.

5. More emphasis should be placed on therapy at the diving school to enable the divers to treat each other in the absence of trained medical personnel.

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SHOCK IN CRANIOCEREBRAL INJURY

Shock is rarely the result of craniocerebral injury. Its presence usually indicates bleeding or trauma in other parts of the body. In these cases the head should not be placed lower than the trunk and the extremities, because this position will aggravate intracranial bleeding. Otherwise shock associated with craniocerebral injuries should be treated without regard to the brain injury. Blood and plasma should be given as needed until the blood pressure levels approximate normal.—SCARFF, J. E.: Surgical treatment of injuries of brain, spinal cord, and peripheral nerves. Surg., Gynec. & Obst. 81: 405–424, October 1945.

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PENICILLIN LOZENGES IN THE TREATMENT OF VINCENT'S STOMATITIS

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Vincent's stomatitis, or Vincent's infection involving the oral tissues, is one of the most stubborn and complex diseases of the mouth. Called "trench mouth" because of its prevalence in the first World War, it was still a problem in the recent one. The fact that causative organisms can be mild and practically dormant in many mouths, and yet can become active, virulent, and epidemic in form under certain conditions, makes it an important problem in the health of Naval personnel. The disease not only keeps men from eating normally, but it also seems to have an insidious effect on mental attitude. Persons with an acute Vincent's infection usually are depressed, nervous, discouraged, and have been known to go to morbid extremes.

In treating this disease, first the organisms on the surface are attacked by the use of drugs which destroy them. If there are no pockets, crevices, or hiding places for bacteria in the mouth, the drugs themselves will destroy all bacteria, and the mouth will be free of disease in a short time. If, on the other hand, the mouth has periodontal pockets, partially erupted third molars, the gum flaps of which are perfect harbors for bacteria, cavities in the teeth, or overhanging fillings, a slow mechanical and surgical process is required in addition to the use of drugs.

The method of treating this disease for the past few years has been a combination of:

1. Applying drugs to the tissues by swabbing, spraying, and the use of mouthwashes.
2. High vitamin diets, with emphasis on those foods containing vitamin C.
3. No use of the toothbrush, which tends to irritate tissue and thus spread the infection.
4. The elimination of all periodontal pockets, calculus, gum flaps, overhanging restorations, cavities, and open contacts which collect food particles.

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Some of the drugs used are hydrogen peroxide, sodium perborate, neoarsphenamine, chromic acid, copper sulfate, and the sulfonamides. They all seem to be effective and have their place therapeutically. Despite these various methods of therapy, however, the treatment of Vincent's infection has often been long, tedious, and sometimes ineffective.

Penicillin was first used locally by swabbing it on the tissues in a 1,000-unit per cubic centimeter solution, in addition to which hydrogen peroxide was used as a mouthwash. This method, along with other routine procedures, seemed effective, but did not satisfy our demands for the best use of the drug. It seemed that if the saliva could have an almost constant, active penicillin content, the Vincent's organisms could be destroyed much more certainly. Consequently lozenges containing 750 units of pure penicillin sodium were developed. The first patients were treated on 6 April 1945.

Since that time over 400 cases of Vincent's infection have been treated with these penicillin lozenges at this activity, and every patient has had complete recovery. The actual length of time before smears have been negative has varied between 48 and 120 hours, according to the severity of the case and the amount of tissue involved. Within 24 hours the patients have remarkable relief from pain and discomfort and can actually resume the mastication of food. The foul odor of the breath, so typical of the disease, has disappeared along with the necrosed and sloughed tissue. In some cases heavy deposits of salivary calculus have started to flake off the teeth. After 48 hours most patients report that the mouth feels normal. This is a much more rapid clinical result than is usually obtained by the former methods of therapy.

The method of treatment is first to spray the mouth with penicillin solution, 250 units per cubic centimeter, and then give the patient 15 or 20 lozenges with instructions to place one between the cheek and gum and allow it to dissolve in the saliva. It takes an hour or more for the lozenge to dissolve, and the patient is instructed to replace it immediately. He is also told to place a lozenge in the mouth immediately before retiring, and to chew it so as to break it up before going to sleep. This will load the saliva with active penicillin and still prevent possible aspiration of the lozenge during sleep. If the patient awakens at night, another lozenge is placed in the mouth and chewed. The flow of saliva is slower during sleep; therefore the pencillin-saturated saliva will remain in the mouth for some time. The patient is given more lozenges the next day, and his mouth is sprayed with the penicillin solution to cleanse surface debris. He is also instructed not to brush either the teeth or gums.

Forty-five cases have been treated with the lozenges without any

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scaling or mechanical treatment except the penicillin spray, and have all become clinically negative in from 2 to 5 days. The remaining patients had light scaling in conjunction with the lozenges and spray. The removal of heavy calculus deposits naturally has a beneficial effect and will hasten the patient's recovery, but the infection can be controlled without this treatment.

It should be borne in mind that nothing should be attempted in the mouth during an acute Vincent's infection which will irritate tissue or expose open bone or tissue to the saliva. Only emergency surgery should be attempted under such conditions.

That the penicillin lozenges seem to be so effective in controlling the disease would tend to indicate their routine use when surgery is attempted in all but very healthy mouths. After the acute infection has been controlled, all procedures should be taken to remove breeding spots of bacteria. Vincent's organisms can usually be found in every periodontal pocket, or in other crevices in the mouth.

Most mouths presenting Vincent's infection have local pockets of infection, pericoronitis, or defects of the teeth or of the restorations present. It must be borne in mind that, even though the bacteria are destroyed, the foci or breeding places in the mouth must be thoroughly eliminated to prevent an early recurrence.

Two types of lozenges having the following formulas have been developed.

Formula No. 1*	*Gm. or cc.*	Formula No. 2*	*Gm. or cc.*
Acacia	30	Acacia	25
Calcium stearate	5	Calcium stearate	5
Sucrose	65	Lactose	70

*Each lozenge contains 750 units of pure penicillin sodium.

The No. 1 lozenge dissolves faster (in about 1 hour) in the mouth and gives the saliva a higher unit content of penicillin.

The No. 2 lozenge dissolves more slowly (in about 3 hours) in the mouth and consequently there are fewer penicillin units in the saliva. Clinical results have shown that in the more severe cases the No. 1 formula is more effective.

It is also to be noted that some of the patients who complained of sore throat seemed to have definite relief in a short time. Preliminary reports from medical officers using the lozenges have definitely indicated that saliva which contains penicillin has benefited throat infections.

Laboratory tests have been made showing that the saliva of patients being treated actually does contain active penicillin with powers to kill bacteria. We are now making extensive tests to determine how

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long the lozenge will last, both with and without refrigeration. Indications are that under refrigeration the lozenge will remain effective for many weeks.[1]

CONCLUSIONS

The use of penicillin lozenges seems to be the most effective method of destroying Vincent's spirillum and fusiform bacillus in the mouth.

2. It is a very simple and effective way to control cases of Vincent's infection not severe enough to warrant injection of the drug.

3. Most cases require only from 30,000 to 50,000 units of penicillin.

4. The use of these lozenges seems to be a much more simple and effective way to control Vincent's infection where large numbers of men are concerned and where treatment by a dental officer is limited.

5. This type of therapy suggests a possible method of controlling epidemic Vincent's in the field and aboard ship.

6. It would seem advisable to test further the length of potency of the lozenges under extremes of temperature and in hermetically sealed containers.

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[1] Lieutenant Commander Ernest R. Barron H(S) U. S. N. R., reported as follows:

"The advisability of assaying the potency of the penicillin lozenges, in so far as time and temperature of storage were concerned, was at once apparent. A tube dilution method involving the use of a susceptible strain of hemolytic streptococcus and a series of standards made up of definite amounts of penicillin enabled us to calculate the potency of a lozenge by its performance in suppressing growth of the streptococcus as compared with the penicillin standards.

"The first observation made on these lozenges was in the nature of a temperature storage determination over a period of time. The tablets had been kept in the refrigerator at a mean temperature of from 2° to 4° C. since their manufacture, and were tested after a period of 5 weeks under such conditions. The results obtained showed that there was practically no diminution in potency from the original 750 units over this period of time under the aforementioned conditions. At 8 weeks the potency of these lozenges had decreased to 500 units, and at 9 weeks, to 300 units.

"A second observation was made on the effect of temperature differences, namely, refrigerator and a mean room temperature of between 26° and 28° C., on the lozenge potency. A period of 4 weeks' storage under these conditions revealed no loss of potency from the original 750 units under both the aforementioned conditions."

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PSYCHIATRIC FACTORS IN VASONEUROPATHY

It was observed that a history of sweaty hands and feet, and a tendency to neurosis, were common among soldiers suffering from peripheral vasoneuropathy after exposure to severe cold. Twenty-four men were therefore submitted to a brief psychiatric examination. The findings suggest that the severity of the foot lesions is related to psychosomatic factors, the man of unstable personality being particularly liable to severe effects from cold.—OSBORNE, J. W., and COWEN, J.: Psychiatric factors in peripheral vasoneuropathy after chilling. Lancet 2: 204–206, August 18, 1945.

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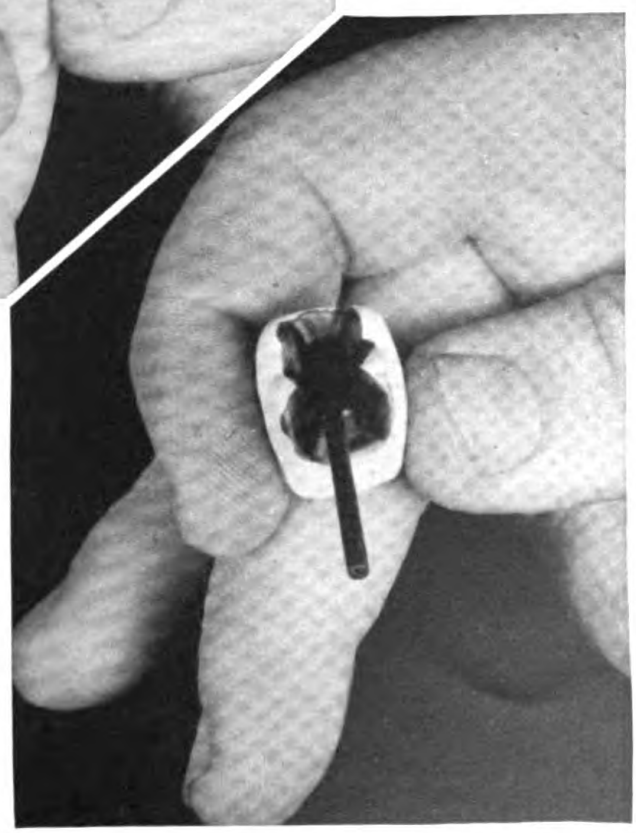
MODIFIED ACRYLIC INLAY

DONALD CALLAR
Lieutenant Commander (DC) U. S. N. R.

Inlays of medium and large size should combine the properties of



1. A box-type preparation is made. The gingival seat has a bold bevel.



2. A sprue is laid across the pulpal floor and the die is inserted.

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esthetics and therapeutic value. To be really esthetic the appearance of shiny metal should be avoided, and to be properly restorative the body of the inlay should not be a conductor of thermal changes.

The acrylic inlay seemed to be the answer to this problem, but in practice presented certain disadvantages which were the opposite of those of the gold inlay. The following technic was therefore developed to combine the two materials and to produce a modified acrylic inlay. This is essentially a very thin cast-gold liner filled with acrylic.

Box-type preparations are made, with an all-around peripheral bevel, not too pronounced. The gingival seat should have a bold bevel (fig. 1). The impression is taken by the usual method, and the die poured in casting investment. After hardening and separation, waxing is done for a gold liner. A thin layer of even thickness is flowed over all portions of the preparation, tapering toward the margins. A sprue is laid across the pulpal floor (fig. 2) and the die carefully invested for casting. As this shell is thin, particular care must be exercised to get a clean casting. A good casting gold and a clean flame are essential to this result.

After casting and pickling, the sprue is cut off even with the axial wall of the preparation. The round part of the sprue that is left on the pulpal floor insures that the acrylic can never come loose for lack of retention. Gold bubbles or other imperfections should be removed.



3. The periphery of the gold is beveled with a tapered stone to a feather edge.



4. The finished inlay is cemented in place with crown and bridge cement.

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This gold shell is then placed in position in the patient's mouth. The fit should be equal to that of a solid inlay. Any discrepancies are remedied by careful burnishing. With a small tapered stone the gold is carefully beveled to a feather edge around the entire periphery (fig. 3).

Heated inlay wax is forced into the gold shell and the patient is asked to close the bite. The anatomic details are carved, the whole is carefully removed from the mouth, and a slight excess of wax is added in the contact area. The tooth shade is taken at this time. The acrylic is carefully forced into this shell. The open-flask method, including tinfoiling of approximal and occlusal surfaces, is better for the purpose than the injector-flask method.

The processed gold-acrylic inlay is tried in the mouth for adjustments and occlusion. It is finally polished with a slow, wet rag wheel, and cemented in place with the proper shade of crown and bridge cement (fig. 4). This inlay has the advantages of accurate seating, good esthetics, being a nonconductor of thermal changes, and of acting as a shock absorber under heavy masticatory stress.




SURGICAL ASPECT OF INTESTINAL AMEBIASIS AND APPENDICITIS

Clinically, acute cecal amebiasis and acute appendicitis have much in common and differential diagnosis may be difficult, but in view of the special risks of operation in cases of cecal amebiasis, every endeavor should be made to obtain a clinical diagnosis, emphasizes Britain's Lt. Col. Philip Hawe. He bases his conclusions on 450 cases of intestinal amebiasis observed at a British general hospital in South India. If exploration proves necessary, manipulation of the cecum should be avoided as far as possible, and unless the appendix is obviously in a dangerous condition, it should not be removed if amebiasis is found; emetine should be given at once after operation.

However suggestive of acute appendicitis, operation should not be advised in any case with an inflammatory mass until cecal amebiasis has been excluded. Amebic appendicitis is regarded for purpose of diagnosis and treatment as an extension of cecal amebiasis; unless complicated by abscess or perforation, it is a medical disease.

Unsuspected intestinal amebiasis and postdysenteric conditions of nonappendicular origin often give rise to symptoms very suggestive of chronic appendicitis. Operation is occasionally required for residual appendicular disease following cecal amebiasis.—HAWE, P.: Surgical aspect of intestinal amebiasis. Surg., Gynec. & Obst. 81: 387–404, October 1945.

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SKIN LESIONS OF RHEUMATIC FEVER[1]

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The discussion of the skin manifestations of rheumatic fever involves two main considerations; first, whether true erythema nodosum and erythema multiforme are specific lesions of rheumatic fever; and second, the characteristics, frequency, and prognostic significance of the known specific rheumatic fever skin lesions.

The first point can be disposed of rather briefly. It has been very ably discussed by Keil (*1*). He points out that in the late nineteenth century when several of the classic works on rheumatic fever were written, the concept of the disease was much more vague than at the present time. As a result of the ill-defined diagnostic criteria, many patients with joint pains were incorrectly considered to have rheumatic fever. Among these were probably persons with erythema multiforme and erythema nodosum, conditions that are often associated with joint pains and a slight fever at the onset. As a result, these skin conditions came to be considered specific lesions of rheumatic fever.

Also contributing to this confusion has been the occurrence of skin lesions of rheumatic fever which in a general way do resemble erythema nodosum and erythema multiforme. Approached from the standpoint of how many rheumatic fever patients have classic erythema nodosum and erythema multiforme, and conversely how many persons with these skin diseases have rheumatic fever or any evidence of cardiac lesions, it can only be concluded that these skin manifestations have no relationship to rheumatic fever (*2*) (*3*) (*4*) (*5*) (*6*) (*7*) (*8*) (*9*). This has been confirmed in our experience.

In 1922 Lehndorff and Leiner (*10*) described under the term "erythema annulare rheumaticum" an eruption that is unquestionably completely specific for rheumatic fever. It is caused only by rheumatic fever. It is a circinate or gyrate macular erythematous eruption. This eruption is seemingly the same as that described by Bright (*11*)

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in 1831 as "roseola annulata" associated with chorea. It was also described by Rayer (*12*) in 1835. Cheadle (*13*) includes an illustration showing a circinate eruption in a patient with rheumatic nodules. He refers to the erythematous skin eruptions of rheumatic fever as "erythema exudativum." Under this heading he mentions erythema papulatum, erythema marginatum and erythema nodosum. Garrod (*14*) and Barlow and Warner (*15*) are also prominent among the early authors describing this annular eruption.

Keil (*16*) makes a classification of a simple papular form (erythema papulatum rheumaticum) and ringed forms, under which he includes as subgroups, erythema marginatum rheumaticum (with elevated borders) and erythema annulare rheumaticum of Lehndorff and Leiner (the nonelevated annular and gyrate form). While he states that the raised ring form as it involutes goes through a nonelevated stage, he feels that the two conditions are different. This seems somewhat artificial, but it is true that the flat type seldom becomes elevated at any time.

In our experience, by far the most common lesion encountered has been the Lehndorff and Leiner type. This eruption is so characteristic that a diagnosis of rheumatic fever can undoubtedly be made by its presence alone. Since this eruption may be the only lesion, or the deciding factor in an otherwise questionable case, it is important that it should be recognized. It is most common on the trunk, less prominent on the upper arms and legs. It is never seen on the face. The lesions consist of rather bright pink circinate and gyrate eruptions, visible but not palpable. The lesions first appear, or become more prominent after the subject has stood a few minutes with the skin bare. The rings are usually 1 or 2 cm. in diameter, but may become as large as 3 inches in diameter. They come and go with remarkable speed in the same manner as urticaria; the pattern changes from hour to hour. The eruption often completely disappears and reappears from day to day.

The demarcation of the lesions varies. In the bright florid cases, the lesions are sharply outlined and appear to occur right on the surface of the skin. In less pronounced cases they are vaguely outlined and gradually fade into a bluish, cyanotic network that seems to lie a little deeper beneath the surface. This condition merges into one indistinguishable from an increased mottling of the skin. It is only because we have followed several individuals through this last stage that we believe this mottling is significant. It seems to be a variation of the true erythema annulare. When the lesions are small and solid, they produce a morbilliform appearance. This is not uncommon. The great majority of the macular annular lesions remain macular at all times. We have seen one or two transitions into the elevated ringed form. Usually, however, the elevated form is raised from the begin-

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ning. The border is smooth, not at all scaly, and is a continuous lesion rather than a group of papules. Except for the raised border, the lesions are identical in appearance with the nonelevated form. At times the edges of the elevated form become urticarial and then the lesions take on such a resemblance to an annular urticaria that a distinction may be difficult indeed. This is further complicated by the fact that the rheumatic lesions come and go in the same fleeting manner as urticaria. It is also made difficult by the fact that urticaria is occasionally caused, according to many authors, by rheumatic fever itself.

It has been our impression that much more urticaria has been present in our rheumatic fever population than would be expected in an average hospital population. It has been impossible to determine the exact cause of the urticaria in most of our cases. It is, in our opinion, reasonable to believe that some of these cases have been either direct manifestations of rheumatic fever or an indirect effect, the patient being more susceptible to urticaria from the ordinary causes because of the well-known vascular instability associated with rheumatic fever.

The other distinctive type of lesion we have seen has consisted of large elevated, slightly edematous, doughy plaques usually appearing early in the course of the disease. Often they are located over affected joints. Large lesions may have a somewhat erysipelas-like appearance. In contrast to the erythema annulare lesions, they respond to salicylates in a manner similar to the arthritic manifestations. As a variation of this type, we have seen some patients with lesions from 2 to 3 cm. in diameter scattered over the extremities and sometimes the trunk. These lesions may have a certain resemblance to erythema multiforme, and over the shins, if quite indurated, they resemble erythema nodosum. This type of eruption, although undoubtedly caused directly by rheumatic fever, can also be produced by drugs. For this reason, it is not as completely distinctive of rheumatic fever as erythema annulare rheumaticum. We believe it is this type of rheumatic fever lesion that has been described as erythema multiforme and erythema nodosum due to rheumatic fever.

There have been few pathologic reports on erythema annulare. Carol and van Krieken (*17*) described a polymorphonuclear inflammatory infiltrate about dilated vessels in the upper cutis. Keil's (*16*) findings were much the same. He found the same type of infiltrate, with some tendency to palisade arrangement and some edema of the blood vessels. We obtained a biopsy in a florid case with rings about 3 inches in diameter. The skin was completely normal. This does not seem unreasonable, as the condition changes so rapidly that one might expect to find little in the nature of inflammation other than dilated blood vessels which might contract on fixation.

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Aside from its diagnostic value, the principal significance of erythema annulare is that it is considered by many observers to be associated not merely with rheumatic fever, but with cardiac damage from rheumatic fever. Such strong statements have appeared as "always associated with cardiac rheumatism" (Sheldon (*18*)), "only appears following endocardial involvement" (Abt (*19*)), "the experienced clinician knows that the fatal end is inevitable" (Leichtentritt (*20*)), "pathognomonic for rheumatic endocarditis" (Lehndorff (*21*) (*22*)), and "one who can recognize the eruption can diagnose the presence of rheumatic heart disease on the mere appearance of the cutaneous lesions" (Urbach and Bleier (*23*)).

Others take a considerably less serious view. Wallgren (*24*) cites many cases in which the outcome was favorable and states that "erythema annulare rheumaticum should not be looked upon in every case as a prognostically unfavorable sign even when cardiac changes are detectable. Nor in our opinion can it be regarded as a pathognomonic sign of endocarditis." Somewhat similar views are held by Perry (*25*) and Schlesinger (*26*). This is also our view.

TABLE 1.—*Cardiac status of patients having erythema annulare rheumaticum*

Status	Number of patients	Remarks
Heart normal at all times	9	More than one attack of rheumatic fever—5 patients. Duration of attack in remaining four, 8, 16, 26, and 60 weeks.
Questionable damage (faint localized systolic apical murmur).	10	Now quiescent (no further damage likely at present in 4 cases). Active in 6; duration present attack 44 to 64 weeks in 5 of these.
Definite temporary damage	3	All quiescent now. No further damage likely at present.
Definite cardiac damage	13	First attack—3 patients. Had had previous attacks—10 patients.

As will be seen from table 1, many persons with this eruption in our series showed no evidence of cardiac damage although their rheumatic fever has been of sufficiently long duration to give ample opportunity for cardiac damage to become apparent. This series may be somewhat weighted by the fact that our patients are older than those in most published series. In at least 50 percent of the cases this eruption appears somewhat later than the joint symptoms. It often acts as an isolated phenomenon, and its course is unrelated to other manifestations of the disease. It appears and disappears without regard for the other findings. It may persist for long periods as the only symptom in an otherwise quiescent case. It was completely uninfluenced by salicylate therapy in 19 of the 20 cases in which we have sufficient data. It therefore poses a difficult problem in evaluation and management. Our opinion is that it should be given the importance of any other single manifestation of rheumatic fever. A patient

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presenting it as the only sign of activity of the disease should be managed in the same manner as an individual who has some other isolated sign such as a persistently elevated sedimentation rate.

SUBCUTANEOUS NODULES

Subcutaneous nodules of fibrous to bony hardness, attached to the tendons, ligaments, and fascia have long been recognized as a lesion of rheumatic fever. They are not completely specific for this disease, similar nodules being seen in other conditions, particularly syphilis (*27*), yaws, rheumatoid arthritis, and possibly in other conditions. Our experience with these nodules agrees with the generally accepted statements in the literature. They are most common about the elbow, then about the knee, and thereafter are scattered about the other joints. Most of our patients have had from 1 to 3 nodules, with occasional patients having showers of from 30 to 40 lesions. The nodules were raisin to almond sized and doughy, fibrous or nearly bony in consistency. Most of the individual nodules run a course of a few weeks, but in agreement with statements by Findlay (*28*), we have seen patients who insisted the same nodule had been present continuously for a year or more.

Our figures on incidence, 46 cases in 835 patients, or 5½ percent, are lower than usually reported (Still (*29*) 27½ percent, Findlay 10 percent, Ingerman and Wilson (*30*) 11 percent, Keil (*31*) 14 percent), but may be a reflection of Findlay's opinion that they are less common in adults. The important point is the prognostic implication of the nodules. It is agreed by most authorities that they indicate a severe type of infection with likelihood of cardiac involvement. Findlay states that all children with nodules have cardiac damage at the same time. Schlesinger reports 40 percent mortality in 90 patients with nodules, followed for from 5 to 10 years.

In our patients, 25 (54 percent) showed definite cardiac damage, and 4 others temporary damage. Salicylates had little effect. Nodules often appeared while the patient was receiving a full dosage of salicylates. In 13 cases the nodules appeared with the onset of the acute symptoms and in 25 they appeared later but during the active stage of the disease. Occasionally they occurred when all other evidence of activity had disappeared. Those patients we have seen with numerous nodules uniformly had severe rheumatic fever with a poor ultimate outlook.

Purpura occurs not uncommonly, most often at the acute onset of the attack, most often on the lower legs and ankles. Occasionally it occurs when the patient first becomes ambulatory after an attack. The bleeding and clotting times are normal and the tourniquet test usually positive, indicating the purpura is due to changes in vascular

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permeability. It is not responsive to salicylates. We do not attribute any particular prognostic significance to its occurrence.

CONCLUSIONS

1. Erythema nodosum and erythema multiforme are not specific lesions of rheumatic fever.

2. Erythema annulare rheumaticum, certain other erythematous skin eruptions, subcutaneous nodules, and purpura are specific lesions of rheumatic fever.

3. Erythema annulare rheumaticum is not invariably associated with valvular heart disease and does not imply a bad prognosis.

4. It is uncertain whether urticaria is caused specifically by rheumatic fever.

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TREATMENT OF DISABLING BACKACHE

The evaluation of the various personal and structural factors constituting a disabling backache provides the basis for treatment. There is certainly nothing to be gained by "claiming" the patient for orthopedics or for psychiatry. Patients respond well, on the other hand, to a focus of interest on the actual disability and the physiotherapists have shown an excellent capacity for acting as therapeutic agents for the team of consultants. Increasing cooperation between orthopedists and psychiatrists may help to give bone and muscle to the aspiration of modern physicians to think in terms of the organism which means the pathology and the treatment of the living person in action.—**Fox, H. M.: Treatment of soldiers complaining of backache. J. Nerv. & Ment. Dis. 102: 154–164, August 1945.**

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PROBLEM OF RECURRENCE IN RHEUMATIC FEVER[1]

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In rheumatic conditions any flare-up of symptoms or signs, no matter how mild, indicating activity of the condition must be regarded as a recurrence. The usual triad of fever, arthritis, and myocarditis is most significant of activity, but chorea, erythema annulare, or other symptoms may occur alone.

It seems important to distinguish the major and minor types of recurrence, as they may be so entirely different, not only in degree, but in importance. For clarity these may be called acute and subacute.

1. Acute recurrence usually follows a streptococcal infection, is violent in nature, and may be just as severe as the original attack. There are fever and arthritis and evidence of myocarditis. Tachycardia, changes in heart sounds, or electrocardiographic abnormalities are found.

2. Subacute recurrence may be very mild and may easily be overlooked. It usually consists of arthralgia or evidence of synovitis, transient fever, with malaise or skin lesions, temporary auriculoventricular conduction delay, or T-wave changes. The sedimentation rate may not be accelerated.

The rate of recurrences in men inducted into the Navy is not available at present. Sampling of several hundred men with rheumatic fever under observation reveals that a fair percentage had the disease one or more times prior to induction. This means that their first attack while in the Navy was a recurrence, and nearly all of these episodes were acute. During their subsequent convalescence, however, even though many of those men had recurrences, the recurrences were all of the subacute type. It has further been noted that among those men who have been returned to duty, and who subsequently had to seek medical attention because of their rheumatic symp-

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toms, practically none had acute flare-ups. Actually only 4 out of 100 were acutely ill, 83 complained of joint pains, and the remainder had some subjective cardiac complaint.

Whether postrheumatic arthralgia and synovitis, which usually appear after extensive increase in activity of the affected joint, represent an actual recurrence may be doubtful, but rheumatic pains of any type when found in the rheumatic patient represent a departure from the normal, and hence imply activity of the condition and therefore "recurrence." Such subacute recurrences are very frequent.

The type and severity of a recurrence is a direct index of the activity of the rheumatic state. It determines the course and prognosis of the individual's disease by revealing his sensitivity to the causative agent. A monocyclic attack, if there is no residual infection, may never recur, but polycyclic attacks, whether acute or subacute, are increasingly likely to continue the more they recur.

Evidence of cardiac valvular damage may appear in the course of time, irrespective of the number of recurrences, and many patients with no sign of activity in the condition develop valvular heart murmurs. Patients with arthritic complaints are less likely to develop valvulitis, but the more closely and the longer rheumatic subjects are watched, the more valvulitis is found.

The treatment of recurrences in no way differs from the treatment of the primary attack. Salicylates seem to be of benefit only if joints are really hot and swollen. They do not seem to relieve simple arthralgia. The matter of bed rest in recurrences is a moot point, but in general it is only necessary to keep a patient in bed as long as signs of activity are present or as long as he feels sick enough to warrant it. If total rest were demanded of every man who has joint pains, many would have to spend the rest of their lives in bed. Methyl salicylate rubs give great comfort and should not be overlooked.

The prevention of recurrences is by its very nature such an integral part of our conception of the etiology of the rheumatic state that the one cannot be considered apart from the other. However, simple hygiene, dust control, and avoidance of chilling, fatigue, and exposure to respiratory infection must all be employed.

The role of the hemolytic streptococcus in the development of the allergic state responsible for the rheumatic syndrome will be considered elsewhere. Suffice it to say here that acute recurrences bear the same relationship to the streptococcus. It is quite evident that minor respiratory infections, overexertion, and chilling play some part in reactivating the dormant process, but often no factor can be found to account for subacute recurrences. Severe fulminating recurrences, however, are much more likely to occur in the wake of virulent streptococcal infection than in the wake of a minor episode.

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STUDIES ON THE PRIMARY ISOLATION OF INFLUENZA VIRUSES

THE PERSONNEL[1]
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In December 1943 Thigpen and Crowley (*1*) reported the first successful isolation of epidemic influenza virus by the inoculation of untreated throat washings directly into the allantoic fluid of embryonated eggs.[2] Further work by Rickard, Thigpen and Crowley (*2*) has confirmed the practicability and ease of this method. These findings are significant in view of several earlier reports of unsuccessful attempts to isolate this virus in the extra-embryonic fluids of eggs (*3*) (*4*). In November and December 1943 a mild influenza epidemic was experienced on the West Coast, during which time throat washings were obtained from patients at a Naval hospital in the San Francisco area. It is considered worth while to report the relative merits of several different methods used in this laboratory for the primary isolation of the virus in fertile eggs.

PROCEDURE

Throat-washing samples were taken from 13 patients who had been admitted to the hospital with a diagnosis of influenza or catarrhal fever, acute. Each patient gargled two 15-cc. portions of nutrient broth (diluted 1 : 3 in saline solution), which were then combined in a sterile lusteroid tube and stored in a dry-ice chest until laboratory tests could be started. Daily garglings were taken on one of the patients for 5 consecutive days to obtain information regarding the duration

[1] The research staff of the Unit consists of: Captain A. P. Krueger (MC), medical officer in command; Commander L. E. Rosenberg H(S); Lieutenant Commanders H. W. Bischoff (MC), A. H. Jacobs (MC), O. J. Golub H(S), J. R. Mathews H(S), and H. M. S. Watkins H(S); Lieutenants J. A. Reyniers H(S), A. J. Glazko H(S), M. D. Thaxter H(S), W. R. Leif H(S), and G. B. Saviers H(S); Lieutenants, junior grade, W. L. Axelrod H(S), I. L. Shechmeister H(S), and W. D. Won H(S); Chief Pharmacist A. I. Teplow H(S); and Pharmacist's Mate, first class, H. R. Burkhead (V–6), all of the U. S. Naval Reserve.

[2] After this paper was written, an article (Eaton, M. D.; Corey, M.; van Herick, W.; and Meiklejohn, G.: Comparison of various methods of demonstrating influenza virus in throat washings. Proc. Soc. Exper. Biol. & Med. 58: 6–9, January 1945) appeared, comparing ferrets, hamsters and chick embryos for primary isolation of the virus.

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of the period during which the virus could be isolated after the onset of fever. Blood samples were taken from all patients on the first visit, and whenever possible a convalescent sample was also obtained two weeks later.

Throat washings were tested by four methods: (a) High-speed centrifugation and adsorption (4 samples only); (b) adsorption and zephiran treatment; (c) direct allantoic inoculation; and (d) Gradocol membrane filtration.

High-speed centrifugation and red blood cell adsorption.—Aliquots of each gargling were centrifuged for 30 minutes at 12,000 revolutions per minute in a high-speed centrifuge. The supernatant from each tube was carefully removed with a syringe and mixed with a suspension of type O human red blood cells to give a final concentration of 1 percent of cells. This mixture was allowed to stand at room temperature for about 5 minutes and was then centrifuged at 5,000 revolutions per minute for 5 minutes. The red blood cell sediment was resuspended in 1 cc. of sterile saline solution, and 0.1 cc. was inoculated amniotically into from 6 to 8 embryos.

Red blood cell adsorption and zephiran treatment.—A concentrated suspension of red blood cells was added directly to aliquots of untreated garglings, giving a final red cell concentration of 1 percent. Adsorption was permitted to take place for from 8 to 10 minutes at room temperature. Zephiran was then added to a final concentration of 1 : 20,000. Twenty-five minutes after adding the zephiran, the mixture was centrifuged for 5 minutes at 5,000 revolutions per minute. The sediment was resuspended in 1 cc. of sterile saline solution, and 0.1 cc. of the suspension was inoculated by the amniotic route into from 6 to 8 eggs.

Direct allantoic inoculation (*1*).—Two-tenths-cc. quantities of each gargling were inoculated without preliminary treatment into the allantoic sac of from 6 to 8 embryos.

Gradocol membrane filtration.—Aliquots of each gargling were filtered through Gradocol membranes of pore size 750 millimicrons, and 0.1 cc. of each filtrate was inoculated into the amniotic sac of from 6 to 8 eggs.

Inoculation.—White leghorn eggs were incubated at 37.5° C. and candled for fertility after 10 or 11 days. Inoculations were usually made when the embryos were 13 days old, although 11- and 12-day-old embryos were used on occasion. Both amniotic and allantoic routes were used for inoculation, as previously stated. All inoculated eggs were incubated at 36° C. for 48 hours.

1. *Amniotic route* (*5*).—The locations of the embryo and air sac were indicated by pencil on the egg shell at the time of candling. After swabbing the shell with 5-percent lysol, a needle puncture was made

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over the air sac, and a V was cut with a carborundum disk over the embryo. The embryo was dropped by suction from the air sac, and a square area of shell was cut out. The inoculation was made with a 1-cc. syringe and a 23-gage needle, following which a wall of sterile valspar was built around the edges of the opening, which was then sealed with a sterile square of glass.

2. *Allantoic inoculation.*—A small area over the air sac and a second area, just beneath the line indicating the air sac and opposite the embryo, were swabbed as before. A hole was made in the air sac, and another cut with the carborundum disk through the shell on the side, taking care not to injure the shell membrane. Inoculation was performed by inserting the needle through the latter hole, puncturing the shell membrane, and penetrating a short distance into the allantoic sac. The two holes were then sealed with sterile paraffin and the eggs placed in the incubator.

Virus passage through eggs.—After incubation for the routine 48 hours at 36° C., the allantoic fluids were tested for hemagglutinins by the addition of 0.5 cc. of fluid to 0.5 cc. saline solution (*6*), following which 0.1 cc. of a 0.75-percent human type O red blood cell suspension was added and the tubes were shaken gently. Observations for agglutination were made on the mixtures after they had stood for several hours at room temperature, or overnight in the refrigerator, and the results were recorded as positive or negative according to the pattern of the cells in the bottom of the tubes (*7*). No fluids were considered to be positive unless a 3-plus or 4-plus agglutination was obtained. Controls, which showed good negative settling in almost all cases, never gave more than a 1-plus reading.

The embryonic tracheae were dissected out and pooled. If the allantoic fluid was negative by this hemagglutination test, the tracheae of the embryos were ground with sterile alundum, diluted to 10 percent by weight in nutrient broth, and reinoculated into additional embryos. This process of testing the allantoic fluid and passing the ground tracheae was continued for as many as five passages before a sample was considered negative. All isolated viruses were tested against the patients' homologous sera as well as with rabbit A and B antisera.

RESULTS

The results on the isolation of virus from throat washings (TW) by various methods are presented in table 1. Virus was recovered from TW No. 13 by all four methods on the first passage. Virus was also obtained from No. 12 on the first or second passage by all methods except (a). Method (b) yielded virus from TW No. 14 on the third passage, whereas the other two methods did not detect it. In addition, this table shows the recovery of virus from TW Numbers 17, 18D, 18E,

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20, 21 and 22 by methods (b) or (c) or both, but the hemagglutinin titer was not maintained on further passage. Of the five consecutive daily garglings taken from patient No. 18, a weak strain was isolated and lost from the last two only, at which time the patient's temperature was normal.

TABLE 1.—*Isolation of virus from throat washings by various methods*

TW No.	(a) Centrifuge	(b) Zephiran	(c) Allantoic	(d) Gradocol	TW No.	(a) Centrifuge	(b) Zephiran	(c) Allantoic	(d) Gradocol
10	—	—	—	—	18B	X	—	—	—
11	—	—	—	—	18C	X	—	—	—
12	—	2	2	1	18D	X	*2	*5	—
13	1	1	1	1	18E	X	*2	*3	—
14	X	3	*3	—	19	X	—	—	—
15	X	—	—	—	20	X	*2	—	—
16	X	—	—	—	21	X	*2	*2	—
17	X	*2	*2	—	22	X	*2	—	—
18A	X	—	—	—					

X Indicates no test.
— Indicates no positives in 5 passages.
*Indicates that hemagglutinins appeared in the passage indicated, but virus could not be recovered in subsequent passages.

Numbers in body of table refer to the number of the first positive passage.

TABLE 2.—*Inhibition of red blood cell agglutination by various antisera against the isolated viruses*

TW No.	Preliminary treatment	Homologous sera		"A" antisera	"B" antisera	TW No.	Preliminary treatment	Homologous sera		"A" antisera	"B" antisera
		Acute	Convalescent					Acute	Convalescent		
12	b	(*)	(*)	2	2	13	b	0	8	8	0
12	c	(*)	(*)	4	0	13	c	0	16	8	0
12	d	(*)	(*)	8	0	13	d	0	8	4	0
13	a	0	16	8	0	14	b	(*)	(*)	2	0

*Indicates that no test was made.

The figures in the body of the table indicate the fold-increase in the agglutination inhibition titers over those obtained in the controls.

Table 2 shows the results of testing the isolated viruses against the homologous sera, PR8 (A) rabbit antisera, and Lee (B) rabbit antisera. Against the isolated virus, the homologous convalescent sera showed significant inhibiting qualities. Less prominent inhibition was also apparent with the PR8 antisera. The B antisera showed insignificant or no inhibition in all eight tests.

Table 3 shows the results of inhibition tests with known viruses on available sera from the acute stages, and from convalescent sera obtained 14 days following the illness. These inhibition tests clearly show that an A virus was responsible for the epidemic, and that this virus was more closely related immunologically to the WS strain than to the PR8 strain. The strongest antibody titer was produced by patient No. 13, from whom the virus with the highest titer was isolated.

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TABLE 3.—*Inhibition of viruses by patients' convalescent sera*

Patient's serum No.	Virus tested			Patient's serum No.	Virus tested		
	PR8 (A)	WS (A)	Lee (B)		PR8 (A)	WS (A)	Lee (B)
12	0	0	0	20	0	2	0
13	2	8	0	21	2	2	0
17	4	4	0				

Figures in the body of the table indicate the fold-increase in the agglutination inhibition titers of the convalescent sera over those obtained with the acute sera.

On the other hand, a virus was readily isolated from patient No. 12, but no significant antibody titer could be demonstrated.

COMMENT

It is apparent from the results of these studies that red blood cell adsorption and zephiran treatment was the most sensitive of the four. Direct allantoic inoculation was slightly less sensitive, failing to detect two weak strains which were recovered by the adsorption-zephiran method. Gradocol filtration, although showing virus recovery from the two most strongly positive washings, did not seem to be sufficiently sensitive to detect the presence of virus in other samples proved positive by the above two methods. This may have been due to loss of virus in the filtration process. High-speed centrifugation with red blood cell adsorption showed some promise for the isolation of virus, but this procedure was more difficult than the others.

The method of choice for the testing of large numbers of washings appears to be direct allantoic inoculation. It was surprising to note the almost complete absence of contamination in embryos so inoculated. The technic is simple, and no preliminary purification of the inoculum is required. A combination of this method with the red blood cell adsorption and zephiran method might perhaps yield even better results.

SUMMARY

1. Tests of four methods for the primary isolation of influenza virus from throat washings taken during an epidemic showed that adsorption on red blood cells and treatment with zephiran yielded the highest number of positive results.

2. The method of direct allantoic inoculation was found to be the most practicable from the standpoint of simplicity and ranked next to the red blood cell adsorption and zephiran treatment in efficiency of virus recovery.

3. Direct isolation of the virus, and virus-inhibition tests of patients' sera, identified the epidemic as due to an "A" strain, immunologically similar to WS.

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STREPTOMYCIN AND TUBERCULOSIS

The results reported in this paper clearly show that streptomycin exerts a marked suppressive effect on experimental pulmonary tuberculosis of the mouse. That the infection is not completely suppressed is shown by the presence of microscopic lesions containing tubercle bacilli. However the infecting dose of tubercle bacilli was large and the period of treatment relatively short. Furthermore since streptomycin is rapidly excreted from the body it is possible that, with the limited number of daily injections used, contact between the antibiotic and the tubercle bacilli in the tissues occurred for only a portion of each 24-hour period. Smaller amounts of streptomycin, especially if given more frequently, might be equally effective.

In terms of units the amount of streptomycin used in the successful experiment was large, 120,000 units per kilo, but was apparently well within toxic limits since no deleterious effects were noted.

These results with streptomycin further indicate that mice may be suitable animals to use when testing chemotherapeutic agents in vivo against human type tubercle bacilli. (The authors administered streptomycin subcutaneously.)—YOUMANS, G. P., and MCCARTER, J. C.: Streptomycin in experimental tuberculosis; its effect on tuberculous infections in mice produced by M. tuberculosis var. hominis. Am. Rev. Tuberc. 52: 432–439, November 1945.

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SEGREGATION OF NEW AND OLD RECRUITS

EFFECT ON AN EPIDEMIC

EPIDEMIOLOGY UNIT NO. 22[1]

The addition of new susceptible recruits in small increments at frequent intervals to an infected population of older recruits in training stations has been considered one of the most important factors in producing a large sick rate at Naval training centers. This report concerns the effect on a streptococcal epidemic of a change in this system of training in one regimental area in a large Naval training center.

During the summer and early fall of 1944, an epidemic of streptococcal disease reached unprecedented proportions at the Farragut Naval Training Station, Farragut, Idaho. Scarlet fever, tonsillitis, pharyngitis and catarrhal fever of streptococcal origin became rampant. This outbreak occurred while sulfadiazine prophylaxis was being given. It was characterized by very high illness rates for streptococcal infections, a high proportion of cases of scarlet fever, and a large percentage of sulfadiazine-resistant strains of Streptococcus pyogenes, beta type, group A. The resistance was shown clinically by the fact that the cases developed despite prophylaxis with as much as 2 gm. of sulfadiazine daily and by the fact that therapeutically the drug seemed ineffective against these strains. It was also shown in the streptococcal typing laboratory at the National Naval Medical Center that these strains were resistant to sulfadiazine in vitro by Wilson's method.[2]

The problem became so acute and interfered with training to such an extent that radical changes in the training program became necessary in order to cope with the problem. Prior to the change, recruits were formed in companies of approximately one hundred

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[1] Personnel of Epidemiology Unit No. 22 during the period of this study were: Commanders Donald C. Young (MC) U. S. N. R., Burtis B. Breese, Jr. (MC) U. S. N. R., Allison F. Errington (MC) U. S. N. R., and Walter Stoeffler (MC) U. S. N. R.; Ensigns Fred A. Zuelzke (HC) U. S. N.; Leroy V. Grussendorf H(S) U. S. N. R.; and Russell R. Harrison (HC) U. S. N.; Chief Pharmacist Grove G. Wiley, U. S. N.; Chief Pharmacist's Mates Edward L. Warmanen and Louis E. Wagshol, U. S. N. R.; Pharmacist's Mates, first class, William D. Harrison, Carl E. Johnson, Peter Packet, and Gene W. Johnson, U. S. N. R.; Pharmacist's Mates, second class, Alfred H. Rodger, Fred W. Elias, Jack Linder, and Samuel W. Pollock, Jr., U. S. N. R.; and Pharmacist's Mate, third class, Herbert Stevenson, U. S. N. R.

[2] WILSON, A. T.: Method for testing in vitro resistance of group A hemolytic streptococci to sulfonamides. Proc. Soc. Exper. Biol. & Med. 58: 130–133, February 1945.

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men at the Receiving Unit, and these companies were then sent in rotation to five recruit camps (A, B, C, D, and E) where they stayed for a training period of from 5 to 12 weeks. As new companies were received, old companies were graduated, thus keeping input and output about equal and each camp with approximately the same number of recruits. Each camp berthed between 4,000 and 5,000 men and was entirely self-sufficient. Relatively little contact occurred between men of different camps during their training period, although men from different camps mingled in some places, notably the large hospital which took care of more seriously ill men from all camps.

Although from a training standpoint this was an efficient method of handling recruits, it had certain disadvantages from an epidemiologic standpoint. New, fresh recruits, with a large proportion of susceptibles, were being continuously added to a population which was infected. Hence if an epidemic began, there was no possible way to prevent its spreading to these new susceptibles and continuing indefinitely. For almost 2 years a high incidence of streptococcal disease had prevailed at this activity, with the exception of a period of several months when sulfadiazine prophylaxis had been effective in controlling infection. With the appearance of sulfonamide-resistant strains in large numbers, this method was no longer of value.

It was the consensus of the medical groups concerned that the control of the outbreak would, among other things, depend on protecting new recruits from the highly infected groups of old recruits. If this were done, it was maintained that the rate of infection would drop and the virulent strains of sulfonamide-resistant organisms would be eliminated. Such streptococcal infections as occurred would then be brought in with the new recruits, and not be due to infection "inherited" through contact with older recruits.

It was, therefore, proposed that one camp be emptied of old recruits, the barracks cleaned thoroughly, and that all fresh recruits be put into that camp until it was filled. These men should remain until graduation. Upon graduation the cleaning process would be repeated and the camp again filled with new recruits who would have no contact with the previous recruits. This was to be done in all camps in rotation, so that as one was filled another would be emptying.

In addition, recruits who developed streptococcal infections were to be put in special companies after returning from the sickbay, so that there would be less opportunity, if they remained streptococcal carriers, for them to infect the normal recruits.

These proposals were put into effect first in Camp E (Camp Peterson). Unfortunately, the closing of the Center for recruit training

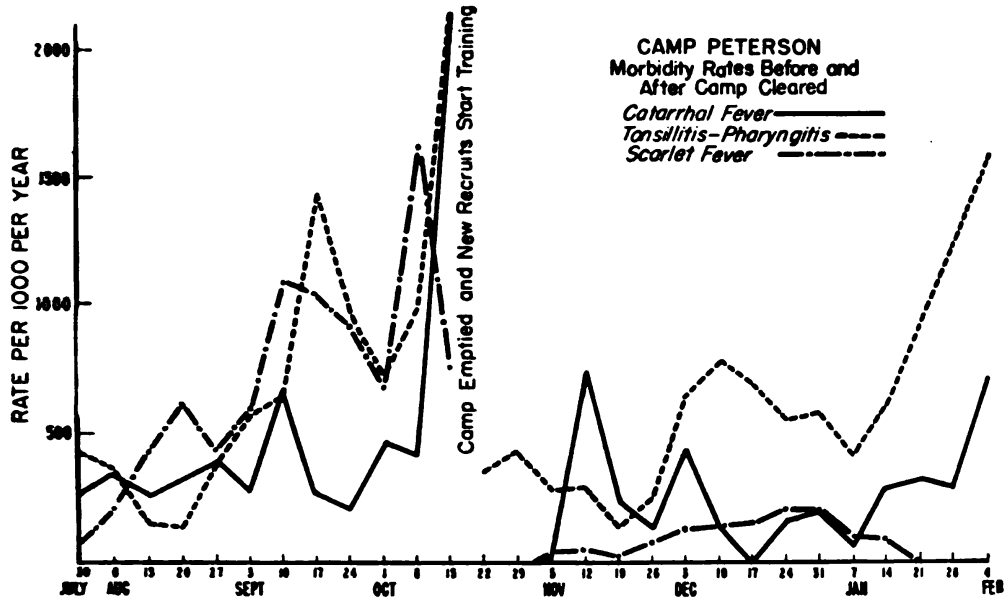
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did not permit the continuation of the program in the other recruit camps as planned, and so our observations were limited to Camp Peterson alone.

RESULTS

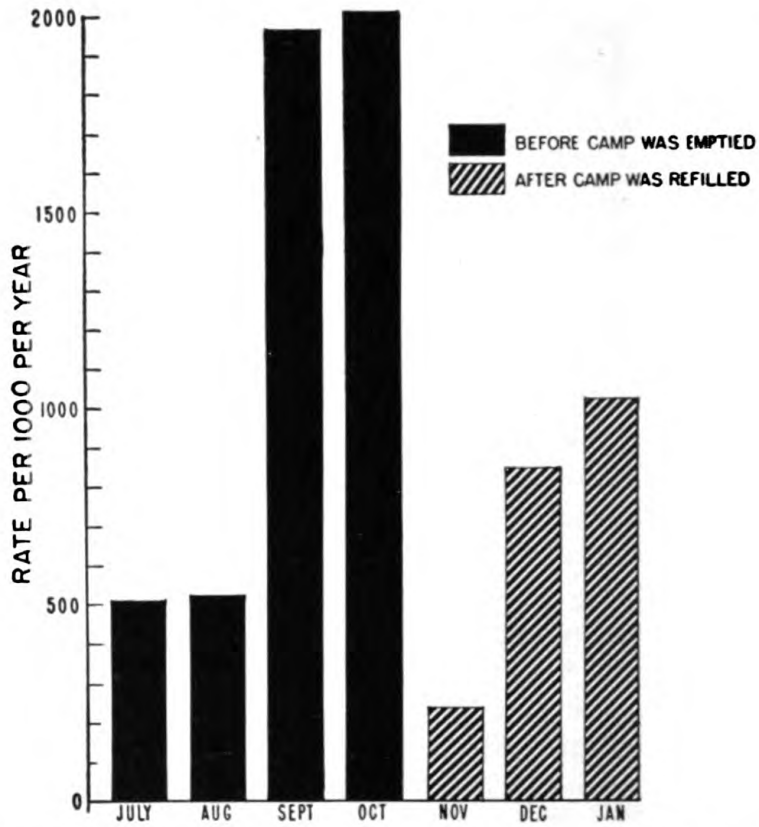
As this camp filled with new recruits, the illness picture changed radically. The incidence of streptococcal infections dropped sharply at first. However this state of affairs did not continue. Streptococcal infections gradually increased in frequency as the recruits neared the end of their training period. This is shown in graph 1. It will be noted that there was an initial rise in the frequency of these admissions, a low point, and then a gradually increasing rate which became very high toward the end of the training period. Similarly, catarrhal fever reached a peak early, dropped in frequency and then again increased toward the end of the training period. Actually the early peaks in so-called tonsillitis, pharyngitis, and catarrhal fever were probably due to virus infections; the late ones to actual streptococcal infection. Scarlet fever did not appear for 2 weeks and then rose to a maximum in the ninth and tenth weeks, disappearing completely for the last 3 weeks.

The streptococcal infection rate can be estimated on the basis of the number of men admitted to the sickbay with positive throat cultures for Streptococcus pyogenes. This is shown in graph 2. The number of such admissions dropped off rapidly and then began to increase proportionately the longer the new recruits remained. The mean annual rate per one thousand for these admissions for the 3-month period from the time Camp E was filled in October 1944, until it was



Graph 1.

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Graph 2. Admission rates of patients with positive throat cultures for streptococcus pyogenes before and after Camp Peterson was emptied and refilled.

emptied in February 1945, was seven hundred fifteen. Three other camps that were gradually emptying during November and December and had not been cleared had mean annual streptococcal infection rates of 1,363, 1,715, and 1,446 respectively.

It would thus appear that, although the streptococcal infections were not controlled, the incidence of these infections was lower than before the camp was cleared, and less than one-half the incidence in camps not cleared. Furthermore scarlet fever incidence was greatly diminished, both relatively and absolutely. The highest rate reached for this disease was approximately one-eighth of the greatest morbidity rate before the camp was cleared.

Although the lowering of the streptococcal disease rates was the primary object of the change, it was of considerable importance to eliminate the highly communicable, virulent, sulfadiazine-resistant types of streptococci present at this activity and responsible for the previous outbreak of streptococcal disease. Types 17 and 19 had been known to cause the majority of such illnesses on the Center for at least a year. When sulfadiazine resistance appeared in these types, they were responsible for 90 percent of the streptococcal illness occurring despite sulfadiazine prophylaxis during September.

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TABLE 1.—*Distribution of types of Streptococcus pyogenes in Camp Peterson before and after emptying and refilling camp*

Strains (types)	Before camp was cleared		After camp was cleared	
	Number typed	Percentage of total	Number typed	Percentage of total
19	118	51	68	41
17	92	40	6	4
24	0	0	49	29
3	9	4	7	4
All others	13	5	37	22
Totals	232	100	167	100

In table 1 a comparison is made of the types of group A Streptococcus pyogenes found in diseases before and after the clearing of the camp. From this table it will be seen that after the clearing of the camp, type 17 practically disappeared, and type 19 became less frequent, whereas type 24 made its first appearance, and the less common types became more frequent. Moreover the proportion of sulfadiazine-resistant strains of streptococci was reduced by 65 percent (table 2). This was largely due to a change in the distribution of types, but it will be noted that the proportion of sulfadiazine-resistant strains of type 19 was greatly diminished.

TABLE 2.—*In vitro sulfadiazine resistance of Streptococcus pyogenes by type before and after clearing of Camp Peterson*

Strains (type)	Before camp was cleared		After camp was cleared	
	Number tested	Resistant to 5 or more mg. (percent)	Number tested	Resistant to 5 or more mg. (percent)
3	2	0	5	0
17	24	100	2	50
19	22	91	36	47
24	0	----	36	0
All others	1	0	34	*29
Totals	49	90	113	25

*All strains showing resistance could not be definitely typed.

This change in the distribution of types was probably responsible for the great decrease in the occurrence of scarlet fever. Previous experience had shown that types 17, 19, and 3 had been very likely to cause scarlet fever. On the other hand, in 22 known infections with type 24 in the previous 10 months, only 1 scarlet fever case resulted. Similarly the uncommon types had been less likely to cause this disease. Furthermore there was some suggestion that the sulfonamide-resistant strains of type 19 were more likely to give rise to scarlet fever than were the nonresistant strains with which we had had experience. Thus in our past experience, of 38 nonresistant strains of

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type 19 isolated from patients, six (16 percent) were associated with scarlet fever; whereas in 220 sulfonamide-resistant type-19 strains, 58 (26 percent) were found in patients with scarlet fever. (This difference could, however, occur by chance 16 times in 100.) With a decrease in the proportion of these potent, erythrogenic, toxin-forming strains of streptococci, scarlet fever was diminished both absolutely and relatively.

In conclusion, although the method of clearing a camp of old recruits before new ones were added did not prevent an outbreak of streptococcal disease, it did reduce the incidence of scarlet fever and eliminated to a large extent the strains of sulfadiazine-resistant streptococci present in the camp before the change. It is probable that these "new" strains were brought in from outside the camp, and not, as had been the case previously, the result of infections contracted from the older "streptococcus seeded" recruit population.

SUMMARY

In an effort to control streptococcal infection at a large Naval training center, a system of introducing and training one entire regiment as a unit was substituted for the usual procedure of the continuous influx and outgo of groups of recruits of company size.

This method resulted in an immediate reduction in streptococcal illness, but as the training program continued an outbreak of streptococcal infection occurred.

The rates reached in this outbreak were less than they had been prior to the introduction of this method of training, and less than one-half as high as in other camps where the method was not used.

The absolute and relative incidence of scarlet fever was greatly decreased.

The distribution of types of Streptococcus pyogenes was different from that prior to the change.

There was a marked reduction in the number of sulfadiazine-resistant strains of Streptococcus pyogenes.

The new strains of Streptococcus pyogenes were less potent in their ability to form erythrogenic toxin, thus accounting for the absolute and relative decrease in the occurrence of scarlet fever.

It is probable that the outbreak of streptococcal infections was largely the result of strains introduced with the new recruits rather than contracted from the older recruits in other camps on the Center.

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DEAFNESS DUE TO NOISES OF WARFARE

JACOB A. WEISS
Commander (MC) U. S. N. R.

Estimates of the expected number of hearing loss casualties in World War II run as high as 150,000. Undoubtedly many cases will remain unrecorded. The author alone has seen nearly 100 cases of impaired hearing, which will be presented in detail in a subsequent publication. This article constitutes a preliminary report of 37 cases, with typical audiograms and an analysis of symptoms.

Harmful noises in warfare are of two general types: (1) Sudden loud detonations, either single (as large caliber gunfire, bursting bombs or shells and explosions of mines or depth charges), or repeated, as in the firing of smaller caliber weapons, ranging from rifles up to 20-mm. guns; (2) prolonged intense noises in connection with aircraft, tanks, Diesel engines, radio operation, and so forth. Most of these causes were included in the cases of this series.

Pathologic lesions in deafness due to noise have been observed in the cochlea; they vary from moderate changes in the sensory cells to complete atrophy of portions of the organ of Corti, with degeneration of the corresponding cells of the spiral ganglion and associated nerve fibers. Minor changes may involute; the more advanced lesions are irreversible.

The harmful level of sound intensity is considered to begin between 85 and 100 decibels for prolonged noises. Warfare noises are well above this level. Some aircraft noises measure up to 130 decibels.

Summary of 33 cases of deafness due to acoustic trauma

Symptoms and signs	Number of cases	Percent of total cases
Deafness:		
Unilateral	12	36.3
Bilateral	21	63.7
Tinnitus:		
Slight	15	44.7
Persistent	16	47.1
Totals	31	91.1
Rupture of tympanic membrane	13	38.2
Otitis media:		
Transient	5	14.7
Persistent	2	5.9
Totals	7	20.6

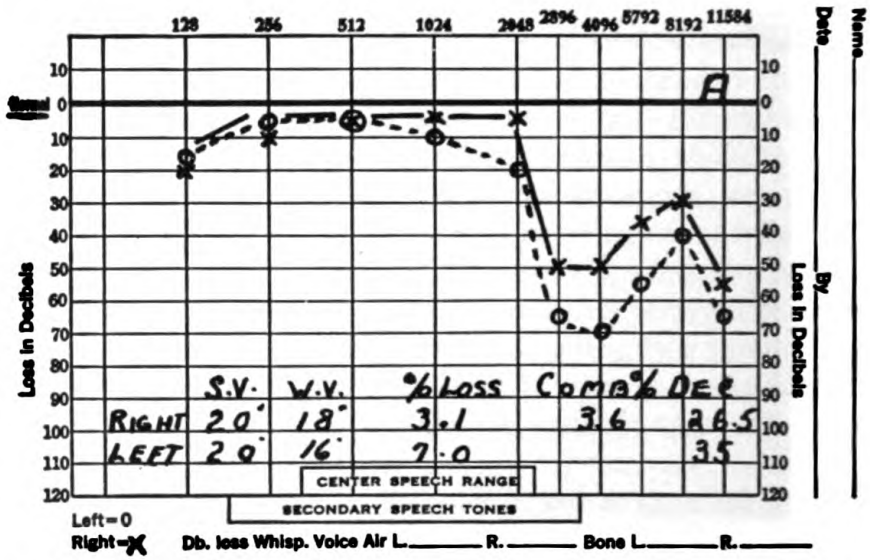
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Large-caliber gunfire may range up to 180 decibels. Characteristics of the sound, duration of exposure, and frequency of rest periods are some of the factors determining the amount of auditory trauma.

The accompanying table gives the incidence of symptoms and signs in 33 cases of deafness caused by excessive sound.

Four additional cases were observed. In three the hearing loss was due to prolonged exposure to the noise of Diesel engines and in one to years of radio operation.

The accompanying figures show typical audiograms of patients exposed to traumatic levels of detonation and prolonged noises. Crosses indicate the right ear, circles the left. Percentage loss of hearing is calculated by the method adopted by the Council on Physical Therapy of the American Medical Association.[1]



1. The captain of a 5-inch gun crew, while firing in action, was knocked down by the blast of the detonation. Cotton plugs, loosely worn in the ears, fell out. The left ear discharged for the first 10 days, with persistent tinnitus. Examination 11 months after trauma revealed a normal appearing right ear drum and a scar of a healed perforation in the left drum. This graph shows the typical V notch which follows moderate trauma, with the greatest decline at 4,096 decibels. The patient is 22 years old.

TREATMENT

The management of blast injury of the ear is limited to the management of associated complications such as ruptured drum or otitis media. Beyond the uncertain degree of spontaneous recovery, very little return of hearing function may be effected.

[1] Council on Physical Therapy: Tentative standard procedure for evaluating percentage of useful hearing loss in medicolegal cases. J. A. M. A. 119: 1108–1109, August 1, 1942.

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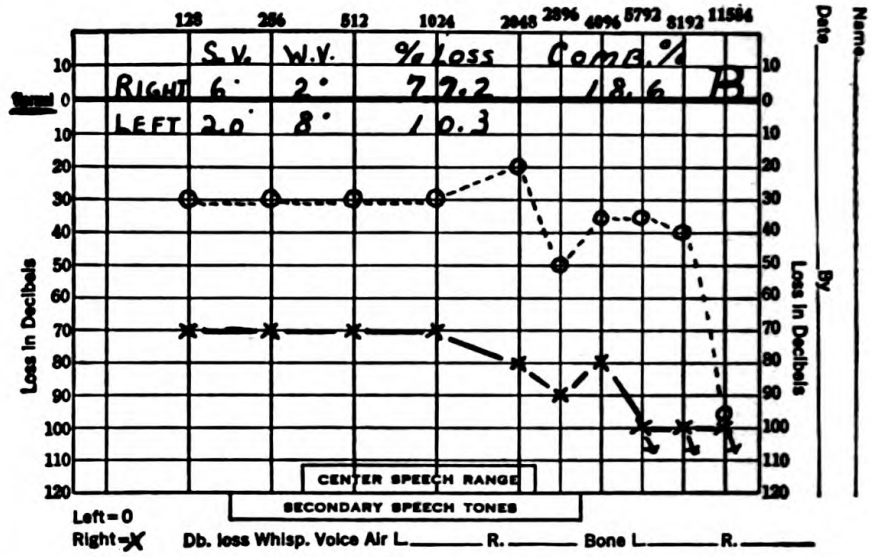


The photograph illustrates a method of attaching the "ear warden" (type V–51R) to the chain of the identification tag to insure constant availability for immediate use as required in an emergency. Although the end of the war makes this suggestion belated, it is still applicable in peacetime operations or training programs. The tab of the "warden" is pierced by a needle carrying a strong thread, which is then tied to the chain at a convenient level. In the illustration the "ear warden" is shown in protective position, properly inserted in the left external auditory canal. The right side shows the plug when not in use.

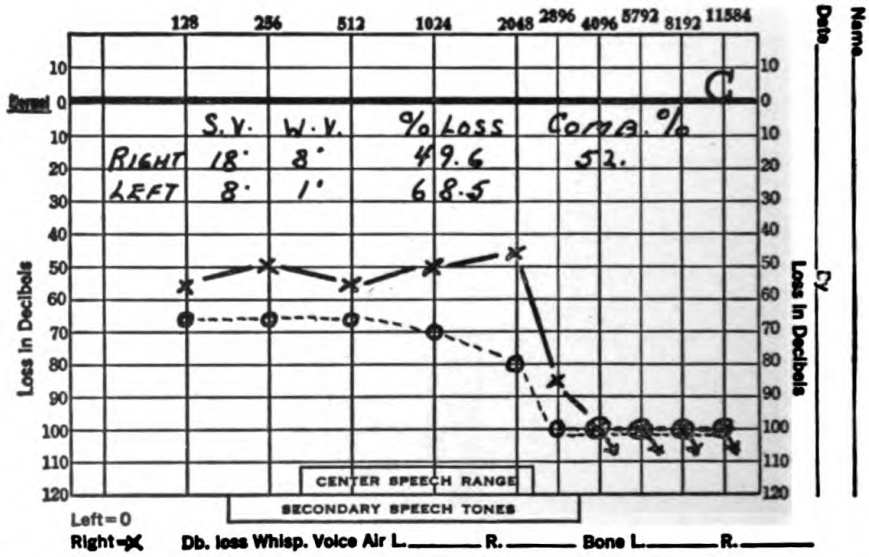
Prevention of the trauma must be fostered by instruction of service personnel in regard to protection of the ears and by the widespread distribution of ear defenders. However, universal use of the "ear warden" was not always feasible under combat conditions.

Objection to the use of the plugs on the basis of inability to hear

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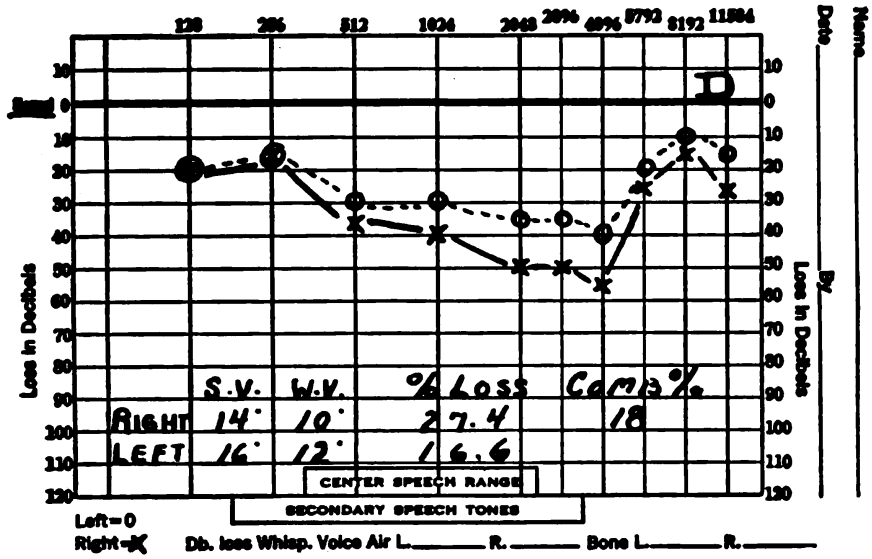


2. This 44-year-old patient was exposed to a single round of fire from a 90-mm. gun located 10 feet to his right. He had pain in the right ear and discharge from both ears for 3 days thereafter. Hearing was completely lost in both ears, but returned on the left side after 2 weeks. Tinnitus in both ears was slight and transient. Examination 18 months after injury revealed two healed perforations in the right ear drum and a single atrophic scar in the left drum.

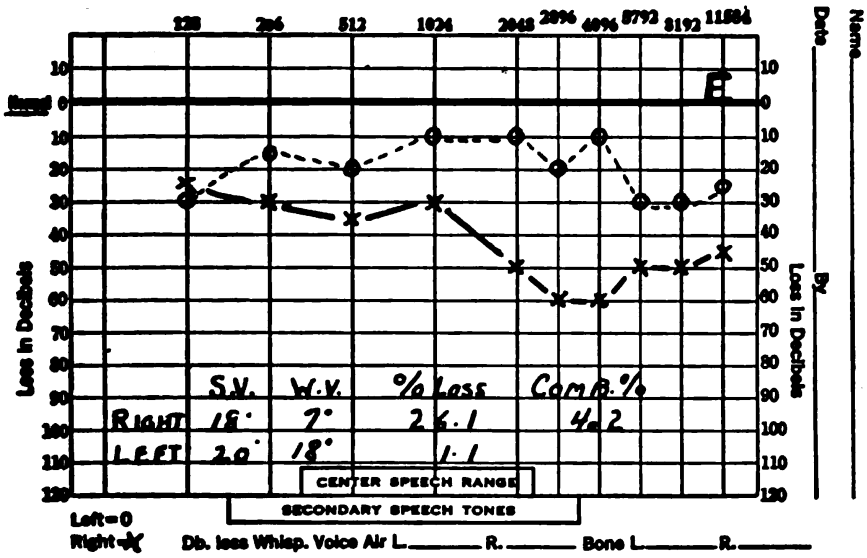


3. This 33-year-old serviceman was knocked unconscious by the bursting of a "large-caliber shell, probably a 14-inch projectile." His ears were not protected. There was no aural bleeding, and pain was moderate. At examination 12 months later the tympanic membranes appeared normal; however tinnitus has persisted in the left ear. This case illustrates severe detonation deafness without rupture of the drums.

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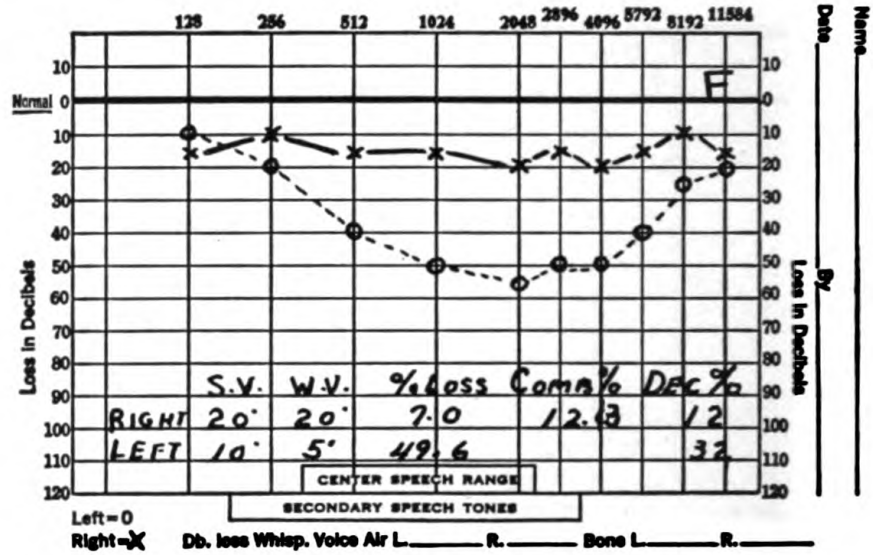


4. This patient, 37 years of age, had a history of duty in a Diesel engine room on a patrol craft for 8 hours daily, 24 days per month for 14 months preceding examination. Difficulty in hearing had been noted for 7 months. At infrequent intervals he had used the Mine Safety Appliance type of ear defender. The tympanic membranes were normal. This graph indicates hearing loss due to prolonged exposures to noise above the hazard level.



5. This 27-year-old patient noted impaired hearing and tinnitus in the right ear following practice firing of a Colt .45-caliber pistol in an indoor range with no protection for his ears. Examination was made 5 days after trauma. The ear drums appeared to be normal. This type of moderate impairment is only temporary in many cases.

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6. G. F. K., 30 years old, had been a radio operator for 13 years. The left ear regularly was used to receive, although the receiver was not worn tightly against the auricle. The usual signal was about 5,792 d. v. and from 80 to 100 decibels in intensity. "Blasting effects" from very strong signals were frequently suffered. A high-pitched tinnitus was present in the left ear. The drums appeared normal. The graph shows the effect on hearing of continued acoustic trauma.

commands and signals is not valid, as a trial will demonstrate that the loud-spoken voice actually is heard better in a noisy environment when the "ear warden" is in place than when the ears are unguarded. This is due to the fact that the plug eliminates excessive extraneous noises.

SUMMARY

Thirty-seven cases of deafness due to acoustic trauma are presented, with six representative audiograms and a tabulation of findings.

The importance of prevention of acoustic trauma, by use of the "ear warden," is emphasized.

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AUDITORY IMPAIRMENT CAUSED BY DRUGS[1]

JOHN C. HOWARD, JR.
Lieutenant Commander (MC) U. S. N. R.

The auditory mechanism is the most sensitive to the action of drugs and toxins of all the nerves of special senses. Certain drugs seem to have a selective action on the auditory system and these drugs unfortunately are some of the most common medications used in prophylaxis and therapy. Quinine, quinidine, salicylates, arsenicals, lead, oil of chenopodium, phosphorus compounds, and mercury may be listed as frequent offenders. A review of the literature reveals, moreover, numerous cases of deafness produced by alcohol and tobacco.

It is, therefore, of interest to study the incidence of hearing impairment due to drugs, as observed in 1,000 consecutive cases in service personnel who reported to the Aural Rehabilitation Service at the U. S. Naval Hospital, Philadelphia, Pa.

The criterion for a diagnosis of deafness was loss of at least 30 decibels in the better ear between the frequencies of 256 to 2,048; this is generally considered to be the conversational range.

There were 12 cases of quinine deafness and 2 cases of deafness from use of salicylates. Cases listed as deafness due to drugs were only those in which drugs were either the sole or the predominating cause. These figures do not include cases wherein drugs might have been a contributing factor, as the effect of drugs in these patients is incalculable.

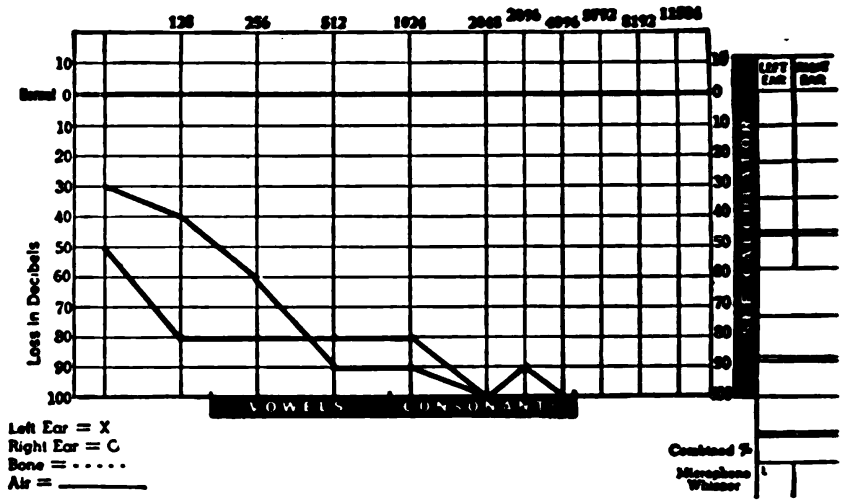
Drug deafness is characterized by a perceptive type of hearing loss with an early suppression of the high tones. As the nerve impairment becomes more pronounced there is a loss in the frequencies of the conversational range and a flattening of the curve of auditory acuity. Rinne's test becomes increasingly positive as the bone-conduction time is shortened.

CASE REPORTS

Case 1.—This patient contracted malaria in 1943. He was given 30 grains of quinine for 2 days and 15 grains daily for 10 days. There was no past history of otorrhea or ear infection, nor was there a history of deafness in his family. The patient was never exposed to heavy gunfire, and his hearing was normal on entrance into the Navy; the ear drums were normal. Audiogram recordings are shown in figure 1.

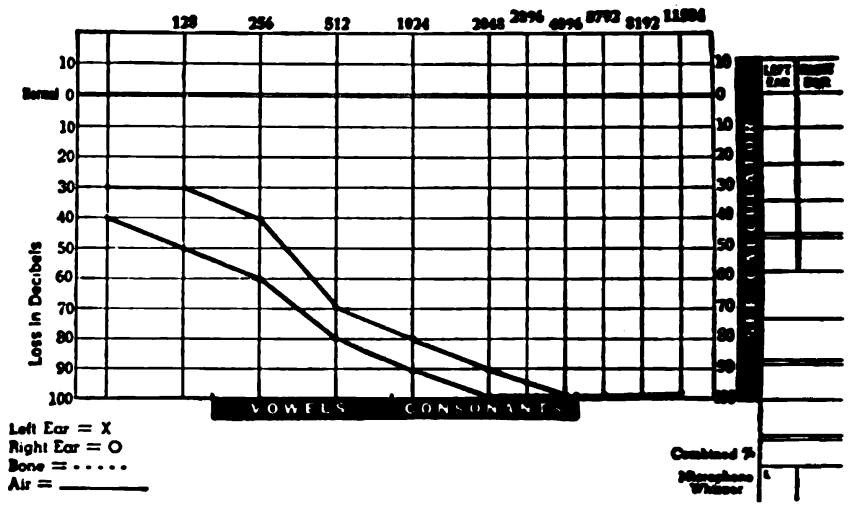
[1] From the Department of Aural Rehabilitation Service of Captain Francis L. Lederer (MC) U. S. N. R., U. S. Naval Hospital, Philadelphia.

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1. Audiogram of patient who had been on quinine therapy for 12 days.

Case 2.—This patient was treated for rheumatic fever with large doses of sodium salicylates. There was no past history of ear trouble nor had there been exposure to gunfire. His hearing was normal on entrance into the Navy and the ear drums were normal. His audiogram is seen in figure 2.



2. Audiogram of patient receiving large doses of salicylates.

The first sign of beginning aural impairment is usually a tinnitus of varying intensity. The early loss of the high tones is not usually noticed by the patient, as his attention is focused on the tinnitus. When medication has been stopped and the tinnitus becomes less pronounced, the hearing impairment is more noticeable. There continues to be a progressive loss of hearing for a short time, due to the drug, even after the medication has been withdrawn.

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Drugs damage the auditory mechanism in various ways. Their toxic effect may be manifest by damage to the ganglion cells of the cochlea, or the endothelial lining of the small capillaries. They may also cause changes of the endolymphatic pressure. Some drugs exert their toxic effect on the protoplasm, whereas others damage the nuclei of the cortical centers of hearing. Certain drugs have a toxic affinity for both components of the eighth nerve, resulting in damage to the vestibular as well as the auditory portion.

Drug deafness in this study was brought about in 11 of the 14 patients during the treatment of disease by massive drug therapy. The three others suffered impaired hearing following a prophylactic dose of quinine.

These figures are considerably lower than is expected. This is partly due to the medical officers' alertness in detecting idiosyncrasies and aural intolerance to the various drugs. However the greatest factor in keeping the incidence of toxic deafness from drugs to a relative minimum is the supplanting of quinine by atabrine in the prophylaxis and treatment of malaria and related diseases.

Quinine.—Quinine remains the drug having the most deleterious effect upon the auditory nerve. Quinine has long been recognized as a specific in the treatment of most forms of malaria, and its life-saving properties are well known. Conversely the history of quinine is replete with cases of aural impairment, ranging from a slight hearing loss with mild tinnitus to total deafness. Physiologically, quinine acting as a protoplasmic poison, has a toxic effect upon the ganglion cells of the cochlea and the associated nerve fibers, the cells of the cochlear ganglia being especially susceptible to injury. Deafness is permanent when the basic coil of the cochlea is injured. There is a hypotonia of the labyrinth and a diminution in the endolymphatic pressure, with subsequent collapse (ectasia) of Corti's membrane. Administration of large doses of quinine, moreover, has been shown to cause hemorrhage into the cochlea of experimental animals.

Quinine readily passes from the blood stream into the spinal fluid by way of the choroid plexus, then into the aqueductus cochleae to reach the hair cells of the organ of Corti. It has been demonstrated that 1 gm. of quinine when given on 2 successive days at weekly intervals for 3 weeks, produces a decrease of 20 decibels in the conversational range. Administration of 0.3 gm. daily for 4 weeks also decreases the auditory sensitivity appreciably during the ingestion of the drug. This hearing loss may become permanent if the drug is given over a long period of time. The amount of quinine necessary to cause permanent injury to the auditory nerve varies according to the patient's tolerance and the condition of the perceptive mechanism of the ear at the time of ingestion of the drug. It will undoubtedly

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have a more deleterious effect on a person who already has a perceptive loss due to heavy gunfire or other aural trauma.

Atabrine.—Atabrine has largely supplanted quinine in the treatment of malaria. It is therefore of interest to note the effect of this drug on auditory acuity. Atabrine is the dihydrochloride of 3-chloro-7-methoxy 9 (1-methyl 4-diethylamino) butylamino acridine, and was a much less popular antimalarial before the war. The lack of popularity of atabrine was due in part to its comparatively late introduction on the market and the disagreeable tendency to impart a distinct coloration to the skin. Atabrine is known to destroy the asexual forms of Plasmodium vivax and P. malariae, but the crescents of P. falciparum are more resistant.

The author tested 126 men after rather massive doses of atabrine and found that it had little or no effect on the hearing. Sixteen of the men, however, developed such severe toxic reactions from atabrine that they were hospitalized. These reactions were manifested by severe gastro-intestinal disturbances, including diarrhea and vomiting. None of these patients were observed to have any complaint referable to their ears or to suffer any noticeable impairment in hearing. At the present time the use of quinine is limited to those patients who show a definite intolerance to atabrine, and for the treatment of certain types of atabrine-resistant malaria.

Quinidine.—Quinidine, another alkaloid of cinchona, used frequently in the treatment of heart conditions and more rarely in the treatment of malaria, has been revealed to be slightly more toxic to the aural mechanism than is quinine.

Salicylates.—Salicylates comprise the second most common drug causing hearing impairment. The use of salicylates is rather general, and attention must be directed to those patients who show an idiosyncrasy to this drug. Salicylates have a tendency to destroy the nerve cells of the spiral ganglion. The drug gains access from the blood to the spinal fluid by way of the choroid plexus as does quinine. Massive doses of salicylates are all too frequently self-administered, without thought of their toxic properties.

Arsenic.—Arsenic is known to affect not only the ganglion cells but also Reissner's membrane. Experimental animals reveal definite histologic changes in both the cochlear and vestibular branches of the eighth nerve due to the action of the drug. The most frequent use of arsenicals is in the form of salvarsan in treatment of syphilis. It is frequently difficult to decide whether the aural damage is due to syphilis or caused by the drug. Syphilis, however, is characterized by a markedly lessened bone conduction. The first sign of aural damage is usually a severe tinnitus within a few hours after injection of the drug.

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Phosphorus.—Phosphorus compounds may cause deafness by changes in the cells of the spiral ganglion, the primary change being in the protoplasm rather than the nucleus. Phosphorus is not usually associated with drug medication, being more of an industrial hazard.

Chenopodium.—Oil of chenopodium is used frequently as an anthelmintic in treatment of ascaris lumbricoides. Deafness caused by this drug is exceedingly rapid, sometimes occurring a few hours after ingestion. It is believed to damage the nerve fibers of the organ of Corti. At the present time this drug is not in the Supply Catalog of the Medical Department, but is found frequently at Naval stations where it was obtained on open purchase.

Mechanical causes.—The auditory apparatus may be rendered more susceptible to the action of the various drugs by the damage to the auditory portion of the seventh nerve from industrial noise, or from the various forms of concussion associated with war.

Particular attention should be paid to tinnitus, described by the patient as "ringing," "buzzing," or "clicking," as this is usually the first warning of an impending aural idiosyncrasy. If a history of tinnitus is elicited, medication such as quinine or salicylates should be given with great care, and substitute therapy employed whenever compatible with the disease.

Quinine therapy no doubt will be more freely employed with the cinchona-producing countries liberated, and an increase in aural impairment may be expected.

CONCLUSIONS

1. Observation of 1,000 consecutive patients with bilateral deafness showed 14 whose deafness was considered to be due solely or predominately to drug therapy.
2. Quinine continues to be the most toxic drug to the aural mechanism, accounting for 12 of the 14 cases.
3. The ratio of deafness resulting from drugs would undoubtedly have been higher if atabrine, which has little deleterious effect on the auditory acuity, had not supplanted quinine in the prevention and treatment of malaria.
4. Tinnitus is one of the earliest and most important symptoms of deafness due to drugs.
5. One should proceed with caution in drug therapy, particularly in the use of quinine and salicylates, in patients with previous aural disease or in those who give a history of exposure to heavy gunfire, especially when tinnitus is present.

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A SURGICAL SERVICE AT A SHORE STATION

WILLARD BARTLETT, JR.
Captain (MC) U. S. N. R.

This report concerns the establishment and functioning of a general surgical service at a typical Naval receiving station. A summary of the operative cases encountered in the first 17 months (1 August 1942 to 31 December 1943) of such a duty is included and the advantages of caring locally for active personnel who require relatively simple surgical procedures are stressed.

The need for such a local surgical service developed during a period of rapid expansion of Naval activities in the area of a large metropolitan port community, and it was intended by the district medical officer primarily to give emergency service for that area, pending the commissioning of the Naval hospital then under construction. This phase covers only the first 5 months of the present report, for the receiving station personnel increased to such a figure that, with the high turnover characteristic of such a station, it became worth while to continue to care locally for our own personnel.

In the second phase of the program essentially the same criteria were applied as to which patients to transfer to the Naval hospital in the area as had formerly governed their transfer to a more remote one. Complicated cases, of which traffic accidents comprised by far the largest number, were given emergency treatment prior to transfer. It transpired that we were also able to start definitive treatment in the majority of such patients while awaiting improvement in their general condition to a point warranting their transfer over a distance of 100 miles by ambulance.

The complement of assistant medical officers on the station during this period was 4, plus 2 dental officers, and the original complement of 12 hospital corpsmen was eventually increased to 18. Medical officers assigned to ships (largely destroyers) under construction, whose crews were attached to the station, were usually available for temporary duty. During the peak of activity, when practically all patients requiring hospitalization in the area were being cleared through the sickbay of the receiving station, the services of members of a mobile hospital unit which was awaiting transportation overseas were available.

The ultimate bed capacity of the sickbay was 85, of which 25 beds were assigned to the surgical service. The operating room had been well equipped on commissioning of the station some months prior to the

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need for its designation as a "semi-hospital." In view of the necessity for maintaining a high rate of turn-over in the limited surgical beds, postoperative patients were returned to barracks during the peak of activity as soon as they were fully ambulatory, and were carried on the sick list, returning daily to sick call on the surgical ward until able to return to their own commands. During the 17-month period there were 3,574 admissions to the sick list.

Of these about 700 were surgical, the 455 operative cases forming the basis of this report. The peak of surgical admissions, 120 in number, occurred in November 1942. During the first 5 months of this period, a 24-hour surgical watch was maintained, pending the commissioning of the Naval hospital for the area.

Since the hospital corpsmen in ships' complements had rarely had previous experience with sterile technic, it was necessary to train the successive members of the three-man operating-room watch and to establish the simplest of routines for preparing and maintaining the requisite quotas of sterile supplies. It is a tribute to the interest and conscientiousness of the enlisted men of the surgical detail that there was less than 2 percent of gross infection of clean wounds. It is also a commentary on the rapidity with which a small number of persons, given individual instruction, can be taught the essentials of a simple, routine technic. Close supervision is essential to guard against occasional attempts at improvisation by those who do not have the necessary background.

In order to give training in operating-room technic to as many of the corpsmen as possible, new corpsmen were assigned to the three-man watch at intervals of 6, 9, and 12 weeks, respectively. One corpsman from each destroyer crew doing temporary duty was included in the team at all times. There was ordinarily sufficient operative surgery so that in less than 6 weeks a corpsman could plan, prepare, and maintain a complete quota of sterile supplies and assist the surgeon adequately in the operating room at whatever activity he might subsequently have duty.

The operations shown in the tabulation on page 394 were performed. Tonsillectomy was performed only occasionally, since the medical officers qualified to perform the operation were frequently too occupied with other duties to divert their time to this purpose.

It is worth noting that of the fractures occurring in 60 patients, only 5 were compound. Fractures of the metacarpals, metatarsals, and phalanges accounted for 22 of the total. Only 6 patients with dislocations of joints were admitted to the ward. Since the great majority of fractures and dislocations were sustained in traffic accidents, multiple fractures were occasionally seen, and such other injuries as contusion of the cerebrum, chest, and kidney were not un-

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Total operations performed

For injuries:	
Reduction of fractures and dislocations	81
Exploration and suture of wounds	27
For nontraumatic disorders:	
Appendectomy	81
Hernia, inguinal, repair	37
Pilonidal cyst and sinus, operations	32
Tonsillectomy	29
Circumcision	22
Ingrowing nail, definitive operations	22
Varicocelectomy	17
Rectal operations	17
Ligation of major saphenous vein	8
Incision of carbuncle and superficial abscess	40
Miscellaneous	42
Total	455

common. Of the 66 patients with fractures and dislocations, 30 were returned to duty, and 36 were transferred to the nearest Naval hospital. Treatment was thought to be definitive, however, in 25 of the patients so transferred. In the traumatic cases other than fractures and dislocations, only one bullet wound was seen.

Acute appendicitis was the gross finding in 69 of the 81 appendectomies. The lesion was mild in 27, moderately severe in 21, and severe in 16; perforation had occurred in 5 patients, none of them attached to the station. Only three direct inguinal hernias were encountered; in these a Bassini type of plastic repair of the posterior and anterior walls of the canal with transfer of the cord structures to the subcutaneous fat was employed. In all indirect hernias the transversalis fascia (which defines the margins of the internal ring) was exposed, and sutured snugly about the cord after high ligation and division of the sac, regardless of what further steps of herniorrhaphy were taken. The cecum and the sigmoid colon were each encountered once in an indirect sac, and appendectomy, orchidopexy or orchidectomy were performed as required. Infection of the fat developed twice in patients with moderately severe appendicitis who were regarded as being "clean cases," and one herniorrhaphy incision also showed gross superficial infection in a patient who developed acute catarrhal fever on the second postoperative day.

Sacrococcygeal cyst, teratoma, was first encountered as a frank abscess and was incised in 13 patients. Excision of the quiescent lesion was done 19 times with primary closure in 17 cases and primary union in all but one. The average postoperative time required to complete healing and return to duty was 12 days. A more extensive series of cases has been summarized elsewhere and the technical procedures

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critically evaluated.[1] Varicoceles were excised only when other source of pain (most commonly prostatitis and seminal vesiculitis or residuals of epididymitis) could be ruled out. The incidence of operations for varicose veins of the leg is surprisingly small. Incompetent communicating veins were usually also present and were divided, in addition to division of all tributaries of the major saphenous veins, at the fossa ovalis, with excision of a segment of the vein, and retrograde injection.

It was the writer's experience at this station, as elsewhere, to find a certain amount of confusion in the minds not only of hospital corpsmen, but often of junior medical officers, in the distinction between simple furuncle, subcutaneous abscess, and carbuncle. These lesions are usually overtreated with hot wet packs. More than 50 percent of the patients in this group admitted to the ward had had inadequate incision performed.

Among the 42 miscellaneous operations, there were three for acute intestinal obstruction due to bands, one incision and drainage with simultaneous tracheotomy for Ludwig's angina, and one incision and drainage of a retroperitoneal abscess of probable appendiceal origin. Of the uncommon disorders encountered, a ganglion of the tibialis anticus tendon sheath, and an arteriovenous fistula arising from a childhood injury to the external plantar artery and its veins are noteworthy.

It is contended that the establishment of a surgical service on the larger shore stations is well worth while. Officer personnel fully qualified to carry on such a service have been regularly assigned to these activities but have not been encouraged to undertake more than the most minor procedures. The advantage to the station of keeping its personnel there is principally the earlier return to duty. Locally, the patient who is fully ambulatory may be discharged from the sick list and returned to light duty, whereas his transfer to another activity may be delayed if he is not yet ready for full duty. Also observation by the surgeon who has performed the operation is frequently possible for a much longer period. This factor is recognized by the patients, and in no instance did a patient refuse a recommended operation during the period covered by this report. It was the practice not to grant liberty to personnel in a light-duty status, nor to those on the sick list, and this is a powerful incentive to recovery.

The administrative procedures and the accounting for patients are so much simpler in the sickbay of the average shore station than in the Naval hospitals, that the health record, where pertinent, can be obtained even before admission to the sick list. Diagnostic pro-

[1] BARTLETT, W., JR.: Pilonidal cyst and sinus, their management and operative treatment. Surg., Gynec. & Obst. 80: 69 74, January 1945.

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cedures and treatment can be undertaken immediately upon admission and the patient returned to duty on the day on which his presence in the ward is no longer necessary to his recovery.

Whenever feasible, the establishment of a surgical service on each shore station whose complement is large enough to afford reasonable activity to qualified personnel and training for the corpsmen would greatly decrease the demand for beds in the Naval hospitals. The cases which the station surgeon should properly pass on to the Naval hospital are those in which consultation is desirable, those in which serious complications are already present or are apt to occur, and those in which more expert nursing care will materially improve the patient's chances for a better result.

During the 17-month period of this report, there were no deaths among personnel on the sick list, nor did a death occur, so far as we were able to learn, in those patients transferred to the Naval hospitals. There were only three fatalities, all of them sudden, among the station personnel. Two of these occurred in apparently healthy persons and were proved at autopsy to be due to coronary thrombosis. The third happened in an organized boxing bout without a "fatal" blow recognizable as such to the onlookers and no anatomic cause of death was found in an exhaustive autopsy.

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SCAR TISSUE FORMATION

Cicatrization is an ideal form of union when epithelization, granulation tissue growth, and absorption are balanced. Normal resorption prevents excessive fibrosis and therefore maintains adequate lymph and blood circulation in the wound. When the by-products of healing remain unabsorbed, cicatrization ceases, granulation tissue shrinks and epithelization is retarded. The fibrosis then interferes with the blood and lymph supply and inhibits further granulation. The untoward result is a large inelastic scar.

The excess of fibrous tissue exerts pressure on the surrounding structures which show atrophic changes. Interference with epithelization is caused by abnormal granulation tissue. The normal epithelial rim measures from 3 to 6 millimeters. The progress of healing is measured by making serial drawings of the rim on cellophane.

Wound healing is hastened by the use of preserved animal tissue grafts. The grafts are placed on granulating wounds or introduced as subcutaneous implants. The preparation of the tissue has been centralized in the Medical Institute at Saratov and the material distributed to several evacuation hospitals. The treatment of wounds by chemically processed tissues has exerted a beneficial influence on scar formation.—KRAUZE, N. I.: Control of scar tissue formation in treatment of wounds. Am. Rev. Soviet Med. 2: 542, August 1945.

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EXPERIENCES WITH X-RAY ON A HOSPITAL SHIP

JOSEPH F. BELAIR
Commander (MC) U. S. N. R.

At first thought it would seem that the work of the x-ray department on a hospital ship should not differ greatly from the routine x-ray procedures, only too familiar to the land-based radiologist. A more thorough investigation, however, will bring to light many interesting and unusual experiences not encountered in hospitals ashore, and incident to the work of a floating hospital in the combat area. The material presented here covers the experiences of a Navy hospital ship in the forward area of the Pacific from June 1944 to June 1945, handling wounded directly from beachhead operations as well as serving as station hospital for a service force in the intervals between amphibious operations.

There is a noticeable difference between the work done while serving as station hospital for the fleet and that done when receiving wounded directly from the battle line. When serving as station hospital ship, some of the technical problems, about which some mention will be made later, are not as vexing as when the ship is underway. The problem of the ship's motion, which causes blurring in the roentgenograph and makes fluoroscopy in the upright position an irksome task, is largely eliminated when the ship is lying at anchor.

When weather conditions make the anchorage choppy, such nonemergency procedures as gastro-intestinal series and examinations of the spine can be postponed until calmer weather. This of course is not always possible, as the patient's ship may be leaving soon and it may be imperative that the work be completed prior to the ship's departure. In general the x-ray work done while serving as station hospital ship is the same as would be expected at any shore hospital where some of the fleet would put in for repairs or supplies. As can be seen in table 1, which covers one period of 4 months as station hospital ship, examinations of the chest, gastro-intestinal tract, spine, and urinary tract lead all other types of work. Many normal findings are noted, but the occasional case of tuberculosis, peptic ulcer, and fracture of the spine that is found seems sufficient to justify the great amount of this work that is done.

The figures presented here are for other than battle casualties. They cover x-ray examinations done during one 4-month period while act-

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TABLE 1.—*Station hospital ship x-ray activities*

Chest	220	Elbow	17
Urographic	111	Forearm	3
Gastro-intestinal series	177	Wrist and hand	83
Skull	26	Pelvis	24
Sinus and mastoid	63	Thigh	8
Gallbladder visualization	10	Knee	80
Spine	182	Leg	7
Shoulder	35	Foot and ankle	98
Arm	4		

Total patients examined	1,015
Total examinations done	1,148
Fluoroscopic examinations	190
Therapy (patients treated)	49
(areas treated)	223

ing as station hospital ship. Several hundred battle casualties were received aboard during this period but they are not included in these figures.

Anomalies of the ribs and vertebrae have been seen many times. Ectopic kidney, persistent metopic suture of the skull, bilateral calcification of the choroid plexus in the cerebral ventricles, bilateral calcification of the adrenal glands, and azygos lobe of the lung have also been noted as incidental findings in routine examinations.

Technical problems in connection with the daily operation of the x-ray department have been many and varied. Each has seemed a major catastrophe when first encountered, but none has proved impossible of solution. The principal ones have been: (1) The motion of the ship causing blurring in the roentgenograph; (2) the difficulty of maintaining proper temperatures in the developing solutions; (3) an inadequate power supply; and (4) a poor physical arrangement for handling a large group of patients in a relatively short time.

The greatly anticipated problem of getting films well dried in a climate where a relatively high humidity prevails did not materialize. The humidity has been present but has not been the handicap that was anticipated. The films were well dried in a reasonable time in a vertical drying cabinet containing a heating element and blower. The time element in this process has been very important; first, because of the large number of cases to be examined, and second, because of a limited number of film hangers.

The problem of motion is ever present when the ship is underway. The ingenuity of all hands has been employed to eliminate it without complete success. An easy solution to this problem would appear to be the employment of radiographic technics of short exposure time. This has been done, but it naturally has its limitations. Employment of short distance, non-Bucky and nongrid technics, and screens also help. Unfortunately many of the examinations which are of the greatest importance to the operating surgeon are of heavy parts of the body, in which the use of the Bucky diaphragm and prolonged exposure time are essential.

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Many factors contribute to motion during exposure; these may not be readily apparent but become an everyday problem to those who work at x-ray on board ship. Given a table which is secured to the deck and a tube which can also be fixed in position, it would seem a simple matter to move the patient to any required position and retain him there with compression bands. Compression bands, however, have been found to be of too little real value and have been eliminated from routine use aboard this ship. The use of sandbags has been of some value in this connection. Necessity has fostered many compromises with standard roentgenographic technics, but only to the extent that the end result was a good diagnostic film. The technics in use now are the result of much trial and error experimentation and are a tribute to the x-ray technicians on board who have worked so diligently to achieve such good results under trying conditions. In this connection it may be of interest to note that two sets of exposure factors are in use; one when underway, utilizing short exposure time, and another when at anchor, using standard technics, so that the maximum of detail may be obtained at all times.

Maintaining developing solutions at a proper temperature has been a problem, the gravity of which varied with the latitude. Much of the time was spent near the equator and this problem was ever present at such times. Some idea may be had of this problem if it is borne in mind that at times the sea-water temperature was as high as 86° F. when it was taken aboard and the fresh water on board 80° F.

The system of temperature regulation for the developing and fixing solutions in the x-ray darkroom on this ship is as follows: A refrigeration unit cools fresh water to 55° F. and it is stored in a 40-gallon tank in the darkroom. Cold water from this tank is mixed with the fresh water of the ship to obtain the desired temperature. There is no provision for recirculating this water back through the cooling system, so that some cold fresh water from the storage tank must constantly be added to keep the temperature of the solutions at or near a workable level, thus losing fresh water into the drains. With this arrangement water must be kept running 24 hours a day or the solutions would heat up overnight.

The darkroom is not large, as all space on a ship is at a premium, and ventilation is an ever present problem. The film drying cabinet and the refrigerating machinery are located within the darkroom and when in operation add considerably to the already high temperature of the room. Although the master tank in which the developing and fixing bath insert tanks are placed is insulated, the difficulty of maintaining the solutions at from 65° to 68° F. in such an atmosphere is apparent.

When operating in more temperate climates this problem has not

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existed. On another hospital ship with an identical installation, this problem was solved soon after being encountered by making the following changes: A cooling coil was installed around the inside of the master tank; the refrigeration machinery was moved outside the darkroom, thus eliminating much heat from within; a light-proof exhaust fan in the darkroom has also added much to the latter installation.

A factor which has contributed somewhat to the limitations of usable technics has been the power supply to these machines. The ship's electric current is direct, and a 25-kilowatt generator supplies alternating current to the x-ray, operating room, eye, ear, nose and throat department, and a few other power and light outlets. This has proved insufficient to maintain adequate electric current for the routine employment of 200 milliamperes, and fast technics have necessarily been limited to those utilizing 100 milliamperes. Two machines in fixed position are in adjoining rooms with their control panels in a small control booth between them. One is a General Electric KX–11 on a motor-driven, tilting fluoroscopic Bucky table and the other is a General Electric KX–12 on a Scanlon-Morris cystoscopic table. Each has a double-focus stationary anode tube and is of 200-milliampere capacity.

The x-ray department is not equipped with a therapy unit, but some superficial therapy has been given for skin conditions. A mobile radiographic unit of 25-milliampere capacity was used. Because the use of a radiographic tube for therapy might ultimately ruin the focal spot for further radiographic work, it was considered advisable to use this machine in preference to either of the two larger radiographic units. A Victoreen r meter was available as part of the x-ray department equipment and this unit was calibrated for 60 kilovolts at 4 milliamperes of current and also at 80 kilovolts and 4 milliamperes of current. In both technics the unit was calibrated for unfiltered radiation and for 1 millimeter of aluminum as a filter.

The output of this unit was not unusually high, but by the use of short distances, 6 and 12 inches, it was found that adequate doses for most skin conditions could be obtained. Doses that would require the machine to be operated continuously in excess of 4 minutes were divided into 4-minute intervals with adequate periods of rest for cooling the tube. To the present, this system has proved quite safe and there is no evidence of any damage to the tube or the unit as a whole. The dental department is equipped with a dental x-ray unit, and all dental roentgenographs are done in this department. Some of the roentgenographic work on fractured jaws is also done with this unit.

Experience has been a great teacher, and changes in methods of loading and distributing casualties have also contributed to elimination of much of the problem of motion due to the ship being underway.

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The physical arrangement of the ship, with one elevator from the wards to the main deck where the x-ray department and operating rooms are located, and narrow ladders between decks, make two-way traffic a real hardship. Originally patients were received on board and taken directly to their wards. When all were loaded and the ship started on her way back, the operating teams began their work. This meant that the patients were roentgenographed on their way from ward to operating room. This worked well enough after the decision to operate had been made, but proved of little help in deciding which patients needed early surgery and which could wait.

After considerable consultation between the loading officers, the operating surgeons and ward medical officers, the present system was adopted. This has worked well and permits of the x-ray examination of all patients who are likely to require surgical treatment during the first 2 or 3 days, or who require an x-ray examination to determine their immediate surgical requirements, at the time they are received on board. It also permits of much x-ray work being done while the ship is at anchor.

As one of the loading officers, the radiologist is on deck when patients are received on board. As bunks are assigned to the patients, their radiographic needs are evaluated, and they are given a ticket on which is marked the part to be examined. They are then taken to the x-ray department on the way to their ward. In this way the additional information furnished by the roentgenograph is available almost as soon as the patient has been received in his ward, and trips in a reverse direction against the flow of traffic from the deck to the ward are eliminated.

The mobile unit has been placed in operation in a surgical dressing room on the deck where most of the wards are located. With this unit, using stationary grids, many head, neck, and eyes cases as well as some injuries of the extremities are roentgenographed. This arrangement divides the load between three machines, on 2 decks, and permits of many patients being roentgenographed as they are admitted and before the ship is again underway. Thus surgical priority on many cases is established early. On one trip in which there were 2 days of loading, 100 patients received roentgenographs on one day and 80 on the next.

The enlisted personnel of the x-ray department is comprised of one chief pharmacist's mate, two pharmacist's mates, second class, and one pharmacist's mate, third class, all of them qualified x-ray technicians. These men have kept three machines and the x-ray darkroom in constant operation during all times when there was a large number of patients to be handled.

The cystoscopic table has done double duty as a general x-ray table and an operating table. By removing the knee rests and the tube with

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its supports from the table, and using a wooden box in the space between the end of the table and the extended foot rest, a full-length table is available. Prior to the removing of the x-ray tube, the table serves for the examination of legs and abdomens. Its use as a general x-ray table is sometimes short-lived because of its urgent need as an operating table, but it is usually in use for x-ray examinations during the loading period of the first day.

TABLE 2.—*Fractures (battle casualties only)*

Part	Simple	Comminuted	Part	Simple	Comminuted
Clavicle	3	28	Femur	26	129
Scapula	12	44	Patella	5	12
Humerus	27	173	Tibia	33	139
Ulna	16	78	Fibula	21	115
Radius	14	82	Tarsals	6	50
Carpals	6	20	Metatarsals	10	64
Metacarpals	22	88	Phalanges (foot)	3	21
Phalanges (hand)	13	72	Vertebrae	14	4
Pelvis	8	30			
Sacrum and coccyx	4	1	Totals	243	1,153

In the demonstration and localization of foreign bodies roentgenographically, changes have been made as experience was acquired. None of the many elaborate and exact methods of localizing foreign bodies have been used. Films in two or more planes have been adequate for our needs. The use of the fluoroscope for removal of foreign bodies has been almost nil. Likewise its use in the reduction of fractures has been very limited and practically nil on war wounds. Fluoroscopic facilities are available at all times in the operating rooms by using the mobile unit.

All parts have been examined in two or more planes. This includes chests and abdomens, which are always done in the upright position; as done here, this is not harsh treatment for the patients. These patients are placed on a motor-driven, tilting Bucky table which is raised gradually, permitting the patient to become accustomed to the change in position. The additional information obtained from anteroposterior and lateral projections of the chest and abdomen in the upright position in these recently wounded patients, over that obtainable from films made in the supine position, makes the longer time required for this procedure well worth while.

Postoperative examinations are not done as a routine. An intercurrent complication is considered the only valid reason for such work. The outstanding exception to this is in cases of wounds of the chest.

In writing up reports of the x-ray findings some short cuts have been instituted which save time but do not sacrifice accuracy or completeness of the record. Foreign bodies are no longer measured but are

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reported as large, medium, small, or minute in size. Inasmuch as the surgeon will see the films on the viewing box before operating, nothing is lost. In like manner fractures are reported as simple, comminuted, or extensively comminuted. The location of the fracture is not designated as being so many centimeters from some anatomic landmark but is described as being in the proximal, middle, or lower third of the shaft of a bone, or in the head or malleoli, as the case may be, and whether or not the articular surface is involved.

Instances of free air under one or both leaves of the diaphragm, always considered so characteristic as to be nearly a criterion for the diagnosis of perforated abdominal viscus, have been conspicuously few. Many patients with abdominal wounds received on board from 2 to 16 hours after their initial abdominal injury in the field have failed to show this sign roentgenographically. These films have always been taken in the upright position and only rarely has air under the diaphragm been demonstrated, even though subsequent operation showed one or more perforations of the intestine.

The passage of a foreign body through a lung, even in those cases in which there was a through-and-through wound of the thorax, is not necessarily associated with pneumothorax or hemothorax. Many such patients were examined radiographically within from 1 to 3 hours after being wounded in the chest, and they showed only a small area of increased density within the lung parenchyma to mark the area where a foreign body had passed through.

Two cases of lacerated diaphragm, with the stomach, omentum, and spleen in the thorax, were diagnosed by roentgenograph preoperatively. One of these patients had been wounded 6 days prior to being received on board and he withstood the operation quite well.

The volcanic ash so prevalent on one of the islands invaded is definitely opaque in the roentgenograph and can be detected readily by its peculiar density. Coral in the soft tissues may so closely simulate the appearance of bone that it can be mistaken for a bone fragment.

The keeping of records in the x-ray department has followed the standard practice. The cases are numbered serially and x-ray reports are made out in triplicate. One copy goes to the ward medical officer for the clinical record, one copy is retained in the envelope with the film, and a third copy is kept as a permanent record in the x-ray department. When patients are examined but are not admitted as patients aboard ship, a copy of the x-ray findings is sent to the medical officer requesting the examination. X-ray films of battle casualties are transferred ashore with them as part of the current clinical record.

Occasionally patients are transferred from a transport where medical attention has been given and a roentgenograph taken. Other patients have been received aboard, after having passed through an

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evacuation hospital hastily set up in the field, who brought with them x-ray films. Because of the urgency of moving these patients to a hospital ship as soon as possible, there is not sufficient time completely to process many of these films, and the films may arrive on board in none too good condition. Reports are written on these films and sent to the ward medical officer. As soon as space in the darkroom becomes available these films are reprocessed. These films also go ashore with the patient when he leaves the ship.

Nearly 4,500 patients have been roentgenographed on this ship during a year's operation. Of approximately 7,000 battle casualties received on board, 38 percent were radiographed while being transported to a rear area. This does not include patients seen in consultation when the ship was acting as a station hospital ship nor those admitted to the sick list as other than battle casualties. Thirty-eight percent of all battle casualties roentgenographed showed fractures of the bones of the extremities or spine. Of this group 243 were simple fractures and 1,153 were comminuted fractures. In this same group, 73 percent had metallic foreign bodies present in the soft tissues.

TABLE 3.—*Metallic foreign bodies (battle casualties only)*

Part	Yes	No	Part	Yes	No
Neck	56	17	Thigh	224	52
Shoulder girdle	152	78	Knee*	99	46
Arm	106	35	Elbow**	41	19
Forearm	112	38	Leg	165	66
Wrist and hand	134	31	Foot and ankle	88	38

*Knee: Lower end of shaft of the femur to upper end of shaft of the tibia.
**Elbow: Lower end of shaft of the humerus to upper end of shaft of the ulna.

The statistics presented here in conjunction with the tables may help give a picture of the x-ray work that has been done on board this hospital ship during the period covered by this report. It is realized that a more complete statistical breakdown, including such cases as chests and skulls and jaws, would furnish other interesting facts but is not available at this time. The figures on fractures and foreign bodies of the extremities are presented because they constituted the major problem in the care of the battle casualties handled by this ship.

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CLINICAL NOTES

POTASSIUM ACETATE THERAPY IN PAROXYSMAL AURICULAR FIBRILLATION

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While engaged in a study of a series of cases of paroxysmal auricular fibrillation, the supply of quinidine sulfate became exhausted and all efforts to obtain this drug from other military and civilian sources on this island were unsuccessful.

The possible role of the potassium ion in the maintenance of normal cardiac rhythm and function has long been recognized and many early investigators determined the effects of this drug on experimental animals (*1*). It remained for Sampson and his coworkers (*2*) (*3*) to apply this knowledge to the treatment of cardiac arrhythmias in the human. They reported the restoration to normal rhythm of ventricular tachycardia and premature systoles. These arrhythmias had appeared spontaneously or had been induced by certain drugs, notably digitalis. Numerous articles by other investigators appeared corroborating their work. Whereas Sampson et al. limited their investigations to the effect of large single doses of potassium salts, an attempt was made in our cases to establish the effect of maintenance doses on the abolition and prevention of the arrhythmias.

One of the patients had been having from 2 to 10 paroxysms of auricular fibrillation each day and these could be abolished by the administration of 1 gm. of quinidine sulfate per day in divided doses. While he was awaiting evacuation to the mainland, the supply of quinidine became exhausted, and he began having the paroxysms of fibrillation again. He was thoroughly digitalized but this had no effect on the frequency and duration of the paroxysms. A consideration of other available drugs which influence auricular fibrillation prompted the selection of potassium acetate as the most satisfactory substitute. Two grams of potassium acetate in elixir of licorice was administered three times a day. This decreased the number and duration of the paroxysms but did not abolish them. Before the effects of larger doses could be tried the patient was evacuated to the mainland and an accurate conclusion could not be reached.

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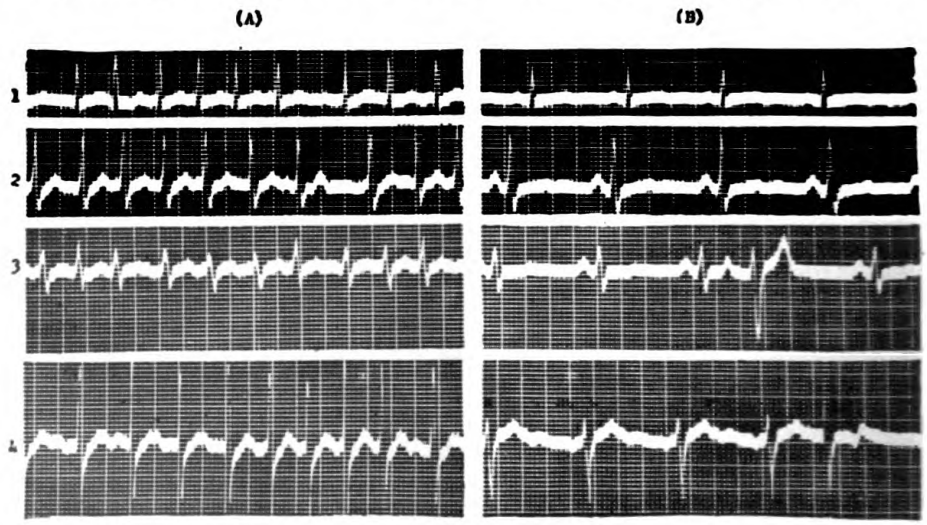
This report is concerned chiefly with the effect of potassium acetate on three patients with so-called "uncomplicated paroxysmal auricular fibrillation." In these three cases no underlying cause for the fibrillation could be demonstrated. During periods of normal rhythm there were no symptoms, and results of cardiovascular studies were completely negative. No reports were found in the literature in which the use of potassium acetate had been studied in the control of "uncomplicated paroxysmal auricular fibrillation."

An attempt was made, in addition, to control a case of auricular fibrillation which had persisted for 12 weeks. This patient had auricular enlargement, and mitral stenosis was suspected as the underlying cause. Potassium acetate, in doses of 2 gm. 4 times a day, did not alter the fibrillation. However, full digitalization and quinidine in amounts as high as 1.5 gm. per day, were equally ineffective in abolishing the arrhythmia. No other cases of auricular fibrillation due to demonstrable organic heart disease were studied.

Details of the three cases in which potassium acetate successfully controlled the arrhythmia are as follows:

CASE REPORTS

Case 1.—This 35-year-old patient had been in the service 8 months. The family history was irrelevant. He denied having any serious illnesses and recalled no past illness except whooping cough and measles. He had been a refrigeration engineer before entering the service. He admitted having been a heavy drinker at one time but had been quite abstemious since being in the service. He smoked about 30 cigarettes a day and drank 3 or 4 cups of coffee daily. He recalled having mild spells of "palpitation of the heart" as far back as 15 years ago. At that time the attacks were infrequent and of very short duration but as the years passed they became more frequent and prolonged, particularly



Case 1. A. Electrocardiogram taken during a typical paroxysm of auricular fibrillation. B. Showing normal sinus rhythm after administration of potassium acetate.

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since he had been in the service. Recently he had been having them several times daily and they lasted from several seconds to 4 hours. They began and ended abruptly. Between attacks he had no symptoms. The attacks showed a tendency to come on after meals when his food "did not agree" with him and the abdomen felt distended. Taking an antacid or soft drink tended to relieve the distention and the palpitation. Exercise seemed to be another factor which would initiate attacks. The attacks were prone to occur while resting *after* he had been exercising. During the attacks he was moderately dyspneic, but his principal complaint was palpitation.

A review of the systems was noncontributory. When examined for the first time, he was in the midst of an attack, and was not dyspneic but appeared moderately nervous and apprehensive. There was no pallor or cyanosis. Body build was average. The examination yielded negative results except for the cardiac findings. The heart sounds were grossly irregular, the apical rate being 150 per minute with a pulse deficit of about 25 per minute. About 15 minutes later, the pulse reverted spontaneously to a normal rhythm with a rate of 80 beats per minute and the blood pressure was 122/66. No obvious abnormality of the size or contour of the heart could be determined. No murmurs or unusual cardiac sounds were audible.

The patient was admitted to the hospital for observation and during the following week had from one to three attacks of fibrillation each day which lasted from 15 minutes to 2 hours. The administration of 1 gm. of potassium acetate three times a day in a vehicle of elixir of licorice was begun. This decreased the number and frequency of the attacks. The amount of potassium acetate was then increased to 2 gm. four times a day with cessation of the attacks. After administering this medication for 2 weeks, it was discontinued, and the paroxysms recurred and soon attained their former frequency.

On resumption of the potassium acetate therapy, regular rhythm became established and was maintained during the remainder of the patient's stay in this hospital. He was evacuated to the mainland, and a letter received from him 1 month later contained the information that he had no more prolonged attacks, but with the excitement of being in the States he occasionally had "small attacks which lasted a second or two."

Case 2.—This patient, 40 years old, had been in the service since July 1943, and was seen for the first time in this hospital in May 1944. His complaint upon admission was lack of energy and palpitation of the heart. He related that he had had an attack of palpitation in 1940 which was treated with drugs and disappeared after 3 days. Later a specialist examined him and said that no organic heart disease was present.

The next attack occurred in September 1943. He stated that he was on maneuvers and his heart began to palpitate. He was given "pills" and the attack terminated in 24 hours. Another attack occurred in December 1943. This episode was terminated promptly by quinidine. An attack occurred in May 1944. He did not apply for medical assistance but decided to carry on his usual activities and took no medication. After 8 days, during which the palpitation continued steadily, he sought medical aid and the attack was speedily terminated by the use of quinidine.

During an attack he did not feel distressed while at rest, but any exertion more severe than walking made him dyspneic and lightheaded and his legs got very tired. Between attacks he had no complaints or undue dyspnea. Ordinarily he smokes about 10 to 20 cigarettes each day and drinks about 10 cups of coffee.

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This present attack began on the morning of 8 January 1945, 1 day prior to his second admission to this hospital. He had had about 10 cans of beer the previous day. In the morning he felt nauseated and vomited and immediately thereafter he felt the palpitation begin. (He usually vomited prior to an attack and thinks that vomiting starts it.) The palpitation continued unabated and he applied for medical aid.

The past medical history revealed that he had diphtheria at the age of 14. He had growing pains when a child but no definite history of rheumatic fever, and no other significant illness. The family history indicated that his father died of Bright's disease at the age of 58; the mother died of influenza, and one sister died of dropsy.

The patient used to be a heavy drinker but since he has been in the service he drinks only beer, sometimes in large quantities. He feels that alcohol had always been a causative factor in the initiation of the attacks but states that he did have one attack during a period of abstinence.

On examination the patient presented a prematurely senile appearance. The hair was sparse; the skin had a sallow tinge. He appeared slightly dyspneic, but not acutely ill. The significant findings were restricted to the cardiovascular system. No sclerotic changes were noted in the vessels of the fundi or in the peripheral arteries.

Cardiac size and contour were apparently normal. Cardiac action was completely irregular; the rate was approximately 168 per minute with a pulse deficit of about 44 per minute. No murmurs were audible. The cervical veins were slightly engorged and the normal venous waves absent. The blood pressure was approximately 138/68.

He was given 3 gm. of potassium acetate and several hours later he vomited. Before retiring that evening he received an additional 2 gm. of potassium acetate and the same amount the following day at 0800. A fourth dose was given at 1100. When seen at 1300 the rhythm had reverted to normal. He had received a total of 9 gm. of potassium acetate.

After cessation of the attack, cardiac rhythm and function were apparently normal. Blood pressure was 132/90. No murmurs were audible. Electrocardiographic findings were within normal limits and there were no significant changes after the "2-step exercise test." Fluoroscopy and x-ray examination revealed normal cardiac size and contour. Basal metabolic rate was minus 16 percent. During the next 2 weeks, while the patient remained in the hospital, he felt quite well and experienced no dyspnea or palpitation. He was examined several times but no arrhythmia was noted even after violent exercise.

Several weeks later he was permitted liberty and drank quite a lot of beer and whisky. The following morning he had a bad hangover but the pulse was perfectly regular and the electrocardiographic findings normal. At about 1000 he became nauseated and shortly thereafter became aware of palpitation. An electrocardiogram showed auricular fibrillation with a ventricular rate of between 110 and 200. The auricular rate was indeterminate.

He was given no medication for 24 hours and the auricular fibrillation continued. Then potassium acetate was started in 2-gm. doses every 4 hours. Several hours after the fourth dose normal rhythm returned. This occurred while he was sleeping and the exact time could not be determined. He remained apparently well and free from symptoms during the remainder of his stay in the hospital.

Case 3.—The essential features of this case are quite similar to those of case 2 and will therefore be presented very briefly. A ship's cook, second class, 22 years of age, was on liberty in the afternoon and drank about 12 bottles of beer during

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a 4-hour period. He also played soft ball but did not exercise to the point of exhaustion. He noted that he was a little more short of breath than usual during this exercise. That evening, while on duty, at about 2200 he suddenly developed a rather sharp pain in the region of the lower left ribs anteriorly and also in the left shoulder. These pains were made worse by moving or upon deep inspiration, and he seemed to be short of breath. Soon after the pain began, he vomited.

He was admitted to this hospital and seen at 0200 the following morning. An electrocardiogram at the time indicated the existence of auricular fibrillation. The apical rate varied from 120 to 150 per minute and the blood pressure was approximately 120/80 millimeters of mercury. The physical examination was not otherwise remarkable.

Morphine sulfate, grain ⅛, and atropine sulfate, grain 1/150, were administered hypodermically. Later in the morning and in the afternoon other electrocardiograms were taken and indicated that the fibrillation was continuing. At 1400 (approximately 16 hours after the onset of acute symptoms), administration of potassium acetate was begun, 2 gm. every 2 hours. After he had received a total of 6 gm., the cardiac arrhythmia suddenly gave way to normal sinus rhythm.

Subsequent physical, electrocardiographic, and roentgenographic examinations yielded negative findings. During the remainder of his stay in the hospital, he received no medication but the cardiac function continued to be normal.

COMMENT

There is ample experimental and clinical evidence in the literature (*1*) that a balanced ratio of sodium, potassium, and calcium ions in the cardiac musculature is necessary to maintain normal irritability and contractility, and that a deficiency of one of these essential ions will result in disturbance of conduction and contraction. The exact physical and chemical effects which result from a disproportion of these ions are not known, but it is believed that the calcium-potassium ratio affects the permeability of the cell membrane to H ions, resulting in their abnormal concentrations on opposite sides of the membrane, thus affecting muscle function.

Regardless of the microchemical and physical reactions involved, it is the consensus that a relative increase in the calcium ion concentration in the heart muscle increases the irritability and contractility of the myocardium, whereas a relative increase in the potassium ion exerts an opposite effect and depresses all cardiac functions (*5*). It is believed by some that digitalis exerts its effect in therapeutic dosage by alteration of the potassium concentration, thus achieving an effect synergistic with calcium (*3*).

Thus cardiac arrhythmias presumed to be due to hyperirritability of the myocardium might be expected to improve as the irritability is lessened by a relative increase in the potassium ion concentration in the cardiac muscle. The investigations of Sampson and his coworkers suggest that the abolition of such arrhythmias is dependent more on the changing ratio of potassium to other ions rather than on their absolute values. These authors were not able to demonstrate an accu-

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rate correlation between the blood levels of potassium and the existence of arrhythmias. They further suggested that the potassium ion might become fixed in the tissue or alter the state of the cardiac muscle, so that an effect was produced which was inconsistent with the absolute potassium level of the blood.

A consideration of the role of potassium in the maintenance of normal cardiac rhythm and the knowledge of the mechanism of auricular fibrillation suggested that this arrhythmia would be benefited by the administration of potassium acetate.

Sampson and Anderson (*2*) reported that auricular fibrillation was unaffected by the administration of potassium. However they fail to state the details of this trial and whether or not their cases were of the paroxysmal type. In their conclusion they suggest that increased age and presence of demonstrable heart disease lowered the apparent effect of potassium.

The three cases reported here all occurred in relatively young persons with no demonstrable cardiovascular abnormalities other than the paroxysmal auricular fibrillation. Accordingly the effect of potassium in these cases would tend to support, indirectly, the inferences of Sampson and his associates.

In the first case reported here there was a frequently recurrent paroxysmal fibrillation which had existed for several years and recurred several times a day. Potassium acetate was effective in restoring normal rhythm, and maintenance doses of the drug prevented a reversion to fibrillation. No cause could be established to account for the cardiac disorder. The second patient had paroxysms which followed drinking bouts in almost every instance. Once begun, these attacks did not cease, even though he abstained from alcohol. Potassium acetate successfully stopped these attacks after about 8 gm. had been administered. In this case the relationship between the ingestion of toxic amounts of alcohol and the resultant alteration in chemical balance of the body offers an interesting field for speculation. The third case was also brought on following a drinking bout.

The effect of potassium salts in the control of premature auricular and ventricular systoles is being studied and details of this study are to be published later. However our preliminary results indicate that potassium acetate in the maintainance doses mentioned is only moderately effective.

SUMMARY

1. The present lack of quinidine salts at some Naval stations makes it imperative that a suitable substitute be found for the control of certain cardiac arrhythmias.

2. Potassium acetate in dosage of 2 gm. four times daily proved

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to be successful in abolishing the arrhythmia of "uncomplicated paroxysmal auricular fibrillation" in the cases studied.

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JAPANESE ARMY RIFLES AS THE CAUSATIVE FACTOR IN AN OUTBREAK OF DERMATITIS VENENATA

Early in November, 13 men reported to the sickbay with skin eruptions. The fingers, backs of the hands, and wrists were involved in all. Seven of the cases were severe, with in addition involvement of neck, chest, and ankles. The eruption was vesicular, accompanied by edema and intense itching. One man had a marked reaction in the inguinal region with a greatly swollen scrotum.

The history of the onset of the disease was identical in all cases. The first area of involvement was the interdigital regions, the webs of the fingers, the backs of the hands, and the wrists. The lesions then spread to other parts of the body. Investigation revealed that all the patients had sandpapered and refinished the surfaces of captured Japanese Army rifles within 1 to 3 days before the outbreak of the eruption.

On the assumption that the Japanese lacquer or stain was the causative factor, patch tests were run on the patients and on controls. The men used as controls were men who had sandpapered and refinished Japanese rifles but who had not developed the rash. The substance used for the patch test consisted of the fine dust-like powder which was obtained by light sanding of the rifle stocks. All of the controls showed no reaction, but positive patch tests developed among those who contracted the dermatitis. It is assumed that the hypersensitivity in these cases was due to the sandpaper scrapings consisting of lacquer, stain, and wood.

As contact dermatitis has frequently resulted from contact with oriental lacquer, it is reasonable to assume that the lesions in this particular episode resulted from Japanese lacquer or stain.—DECARLO, J., JR., Lieutenant, junior grade (MC) U. S. N. R.

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DEXTROCARDIA IN ASSOCIATION WITH A SHORT P–R INTERVAL WITH PROLONGATION OF THE QRS COMPLEX

REPORT OF A CASE

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A short P–R interval with a prolonged QRS complex, as described by Wolff, Parkinson, and White[1] in 1930, has since then been frequently reported. It is known that this disorder occurs most often in healthy young males without organic heart disease, but it has also been seen in association with organic heart disease. In Bishop's[2] review of the literature in 1937, he found that, up to that time, no cases in conjunction with congenital heart defects were reported. Recently Palatucci and Knighton[3] made a clinical study of this condition demonstrating interesting variations shown in the electrocardiograms.

Attacks of paroxysmal auricular tachycardia and auricular fibrillation are frequently characteristic of this condition. Atropine or exercise will often cause the electrocardiographic pattern to return to normal, or the return to normal may occur spontaneously. It has also been noted that during a paroxysm of tachycardia, the QRS interval may become normal. At the U. S. Naval Hospital at New Orleans, La., three cases of this syndrome were seen, one in association with the congenital anomaly of dextrocardia. In view of the rarity of this unusual congenital anomaly in association with the Wolff, Parkinson, and White syndrome, the following case is reported.

Case report.—A yeoman, first class, 31 years of age, was referred to the cardiac department of this hospital for an evaluation, as he was being transferred. His father died of tuberculosis at the age of 61 years, and his mother is alive and well. He has four siblings, all well, although one brother was turned down by the Navy because of some heart disorder. He had the usual childhood diseases

[1] WOLFF, L.; PARKINSON, J.; and WHITE, P. D.: Bundle branch block with short P–R interval in healthy young people prone to paroxysmal tachycardia. Am. Heart J. 5: 685–704, August 1930.

[2] BISHOP, L. F., Jr.: Bundle branch block with short P–R interval in individuals without organic heart disease; case report with review of literature. Am. J. M. Sc. 194: 794–800, December 1937.

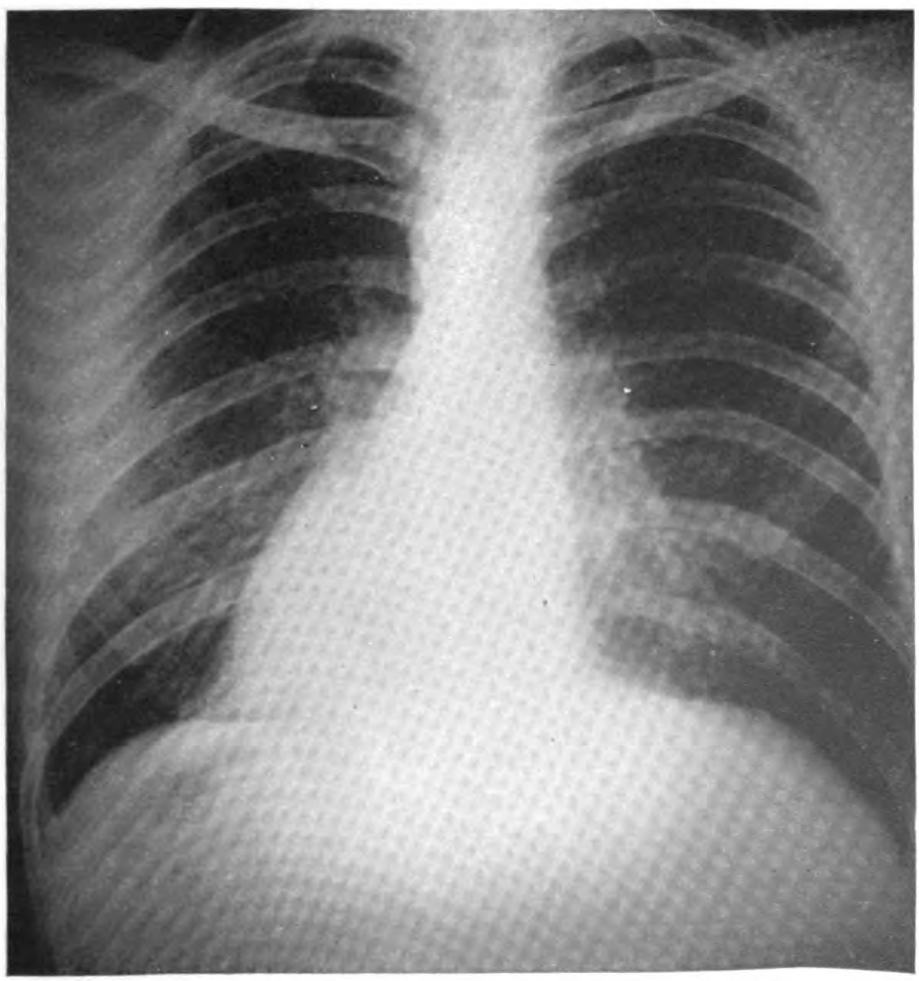
[3] PALATUCCI, O. A., and KNIGHTON, J. E.: Short P–R interval associated with prolongation of QRS complex: clinical study demonstrating interesting variations. Ann. Int. Med. 21: 58–69, July 1944.

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of mumps, measles, and whooping cough. As a baby he had had pneumonia twice. He has had no operations. He had always felt well and while in high school he participated in all forms of athletics. In 1937 he took out some life insurance and, in view of the family history of tuberculosis, a routine chest roentgenograph was taken, at which time it was noted that his heart was on the right side.

In July 1942, while running up some steps, he felt as though he were going to faint. His heart began to beat rapidly and to give him pain. He consulted a physician who gave him a sedative and put him to bed. When he awoke the next morning, he felt perfectly well but was kept in bed for an additional 2 days. He enlisted in the Navy in December 1942. In February 1943, while in church, he suddenly developed a headache with dizziness, and fainted. A Naval physician who was called noted that his pulse was rapid and totally irregular, and he was admitted to the hospital, where the attack lasted for 10 hours. After 4 days he was discharged from the hospital and since then he has felt perfectly well and able to perform his duties. His personal habits are good. He does not smoke or take alcohol, and he has no history of venereal disease.

Physical examination showed him to be a well-developed and well-nourished male, 5 feet, 8 inches tall, weighing 152 pounds, and not appearing to be ill. Examination of the heart showed the apex to be in the fifth interspace below

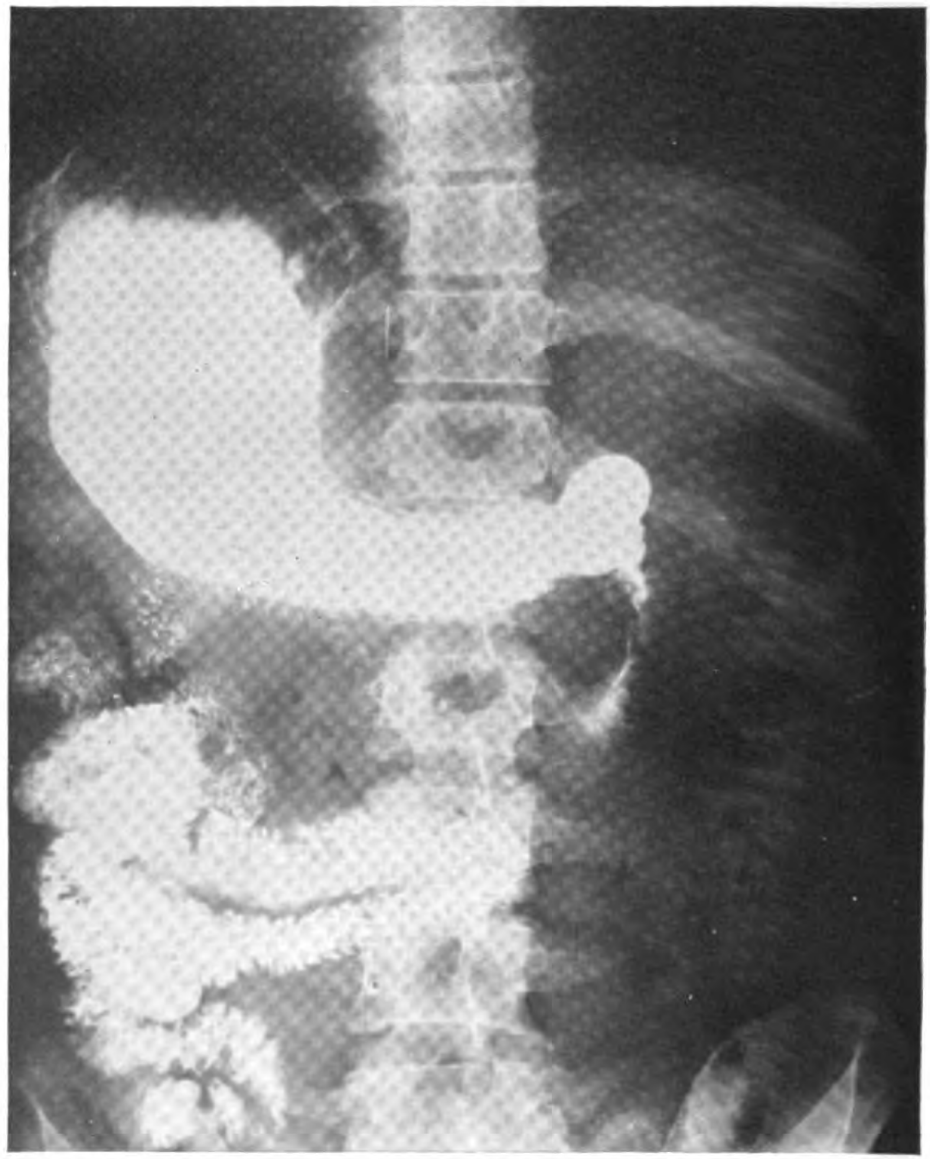


1. Roentgenograph of chest showing dextrocardia.

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the right nipple. The sounds were of good quality, with no murmurs, thrills, or irregularity. The pulse rate was 80 beats per minute, and the blood pressure 114 systolic and 64 diastolic. No other abnormalities were noted.

Blood studies showed the hemoglobin concentration to be 12.8 gm.; the red blood cells 5,130,000 per cu. mm., and the white blood cells 6,700, with a normal differential. The blood cholesterol was 168 milligrams percent and the fasting blood sugar 83 milligrams percent. The urine was essentially normal. The Kahn test was negative. The basal metabolic rate was plus-one.



2. Gastro-intestinal roentgenograph showing the stomach in the right side of the abdomen.

X-ray examination of the chest revealed the heart to be a mirror image of the normal, with the apex pointing to the right (fig. 1). A gastro-intestinal roentgenographic series showed the stomach to be on the right side of the body, pointing to the left. The cecum and the appendix also were on the left side (figs. 2 and 3).

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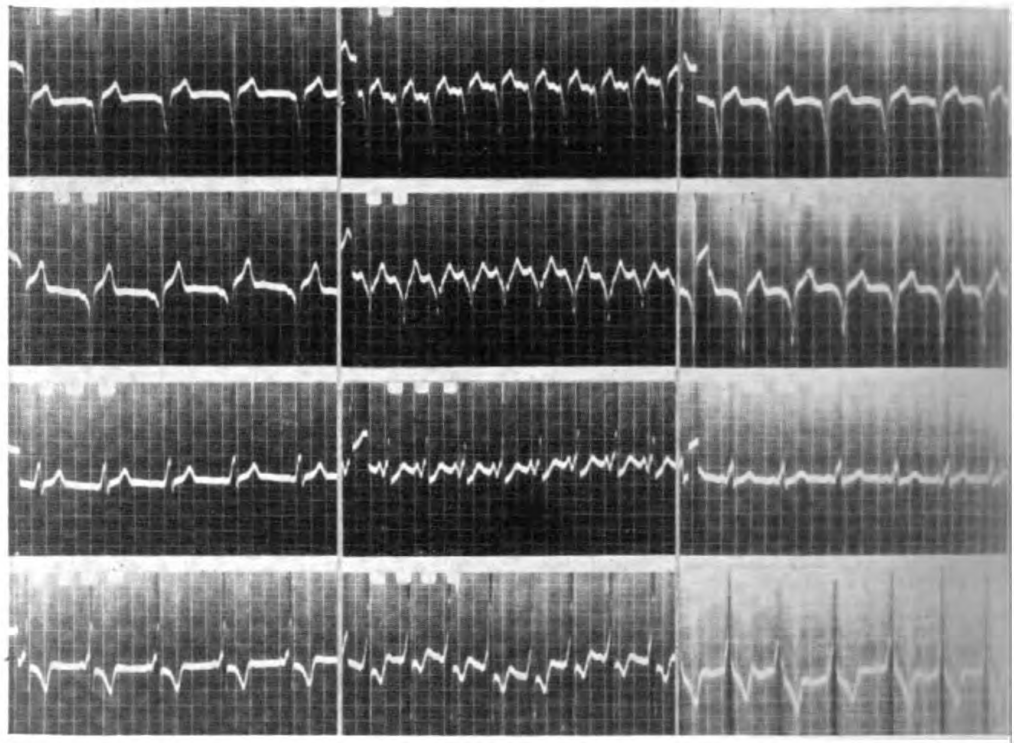
3. The ascending colon, cecum and appendix are shown in the left side of the abdomen.

The electrocardiogram (fig. 4 (left)) showed the characteristic pressure of a dextrocardia with a complete situs inversus, lead I being completely inverted and leads II and III transposed. In addition the electrocardiogram showed a regular sinus rhythm with a rate of 70 beats per minute. The P–R interval varied between 0.08 and 0.10 second, and there was a QRS of 0.12 second. The initial ventricular deflection was slurred in all standard leads.

It may be noted that the third tracing shows the waves more clearly. In lead I there is an inverted P and a wide inverted R, followed by an upright T wave. Lead II is similar but shows a downward and wide QS deflection. In the Wolff, Parkinson, and White syndrome, if there is a large R wave in lead I, the T wave is commonly inverted. The tracing shows the same phenomenon as observed in dextrocardia and in the Wolff, Parkinson, and White syndrome.

In order to determine the effect of exercise on the electrocardiogram, the patient was required to run a quarter of a mile at a rather fast pace, and

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4. (Left) Original electrocardiogram showing characteristic picture of dextrocardia. All precordial leads were taken over the left ventricular apex. (Center) After exercise. (Right) After atropine sulfate, grain 1/150, for three doses.

then a tracing was taken immediately. The electrocardiogram (fig. 4 (center)) showed a normal sinus rhythm with a rate of 136 per minute. There was some variation in the amplitude of the QRS complexes associated with rapid respiration. The P–R interval measured 0.10 to 0.11 second. In lead II it was almost impossible to determine accurately the P–R interval, and the QRS appeared wider, while in the other leads the QRS interval was 0.12 second.

A third electrocardiogram (fig. 4 (right)) was made after atropine sulfate, grain 1/150, had been given hypodermically every 4 hours for three doses. The drug had apparently little effect, and the electrocardiogram showed a normal sinus rhythm with a rate of 88 beats per minute. The P–R interval measured about 0.10 second.

Exercise and atropine failed to abolish the electrocardiographic abnormality.

SUMMARY

A case of dextrocardia in conjunction with the syndrome of the short P–R interval and prolonged QRS complex is presented. The combination of these two entities in the same person is a rare occurrence. This patient, although he had these congenital anomalies, was able to perform all his duties.

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PENICILLIN IN TREATMENT OF MADURA FOOT

REPORT OF TWO CASES

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HAROLD M. DIXON
Captain (MC) U. S. N. R.
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FRED D. WEIDMAN, M. D.

Madura foot seldom originates in the United States. Up to 1931 only 26 reported cases were found by Jones and Alden (*1*). The two cases to be reported here were both contracted outside the tropics, one of them within the continental limits of the United States. They were unusual also in that the fungus species found were Monosporium apiospermum and Cephalosporium granulomatis, which rarely cause Madura foot. For several years one of these cases was regarded simply as an osteomyelitis. In relation to penicillin therapy, our experience tends to indicate that this condition is falling into a group which includes actinomycosis; in this group the drug has high therapeutic value, but thus far has failed to achieve permanent cure with any certainty.

CASE REPORTS

Case 1.—A 57-year-old veteran of World War I came to the United States from Italy while a child. He suffered a minor injury to the right heel in October 1935 while working on a WPA project. Both the heel and foot became swollen and painful. After a 6-month period of desultory improvement under treatment, followed by a relapse, he was admitted to a United States Naval hospital on 25 April 1936, and a diagnosis of "cellulitis" was made.

In addition to the swelling and redness there were numerous vesicles on the inner aspect of the ankle and sole, underlaid by core-like masses which exuded a watery, yellowish material when incised. Posterior to the internal malleolus, the parts were tender and pus exuded on pressure. The entire foot was tender to deep pressure. There were no localized areas of fluctuation and there was no evidence of phlebitis or lymphangitis.

Roentgenographic examination did not reveal any lesions of the bones. Roentgenograms of the chest also yielded negative findings, and physical examination did not disclose any abnormalities; moreover the findings at the physical examinations during all of the subsequent visits to the hospital remained without positive diagnostic significance.

Laboratory examinations likewise did not reveal any significant findings except a mild grade of anemia (a minimum red blood cell count of 3,500,000). The

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same was true during four subsequent admissions. The laboratory studies included urinalyses and blood examinations, blood Kahn tests, determination of blood sedimentation rate and coagulation time, complete study of the spinal fluid for evidence of syphilis, cultures of pus for bacteria, and staining for acid-fast microorganisms.

Under simple palliative treatment and bed rest the condition improved, and 6 weeks after admission the patient was discharged as cured. At an incidental visit 15 months later, the patient's only complaint about the foot was slight swelling and numbness.

Nearly 5 years later the patient could not walk, and he was readmitted on 19 February 1941. He had been treated haphazardly at home, going to work "off and on." The foot was swollen and edematous. Roentgenographic examination included the tarsals and metatarsals of the right foot. Along the shafts of the second, third and fourth metatarsals there were definite, conspicuous, periosteal proliferative changes. A slight decrease in the joint spacings was noted between the tarsals and between the second, third and fourth metatarsals. The first and fifth metatarsals showed no x-ray evidence of osseous changes. There was a general demineralization throughout the proximal ends of the first, second, third and fourth metatarsals, and in the phalanges of the adjacent toes.



1. (Case 1). Radiograph demonstrating destructive processes in bones 1 year prior to instituting penicillin therapy.

In the proximal third of the shafts of the second, third and fourth metatarsals were what appeared to be small punched-out areas of demineralization of sufficient degree to destroy the normal cancellous architecture of the region. The adjacent tarsals showed none of these osseous changes. The long bones, the pelvis, and the bones of the chest and skull appeared to be normal.

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At operation on 26 May, a yellowish-white mass was found subperiosteally over the head of the third metatarsal bone and was removed. The condition was still diagnosed as osteomyelitis. Four months after this admission the patient was discharged with the foot in a plaster cast, and was referred to the outpatient department for subsequent dressings.

By 5 May 1942, in addition to the dusky red swelling previously recorded, the condition had extended to both the dorsal and plantar surfaces of the foot and the patient was admitted for a third time. Roentgenographs showed definite changes as compared with those of 1941. The periosteal proliferative changes in the second, third and fourth metatarsals had increased in the proximal halves. Distally, in the third metatarsal, there was a fairly large area of destruction of the shaft. The first, second and third cuneiform bones now showed periosteal proliferative changes. The punched-out areas of bone destruction in the proximal thirds of the cuneiform bones had increased. The fifth metatarsal remained intact without any evidence of osseous changes, as did the first metatarsal.

Again, under palliative treatment and rest in bed, the condition improved, and although there was still a certain amount of discharge from the sinuses, the patient was dismissed about 2 months after admission.

Intense pain and swelling compelled a fourth return to the hospital on 18 May 1943. The patient was well-nourished at this time and had gained several pounds since his first admission 7 years previously. The right foot was greatly swollen and inflamed. It exhibited a surgical scar on the dorsum, measuring 2 inches in length, remaining from the previous operation. At various points, there were tender areas, together with scars from healed lesions (fig. 2).

Roentgenographic examination indicated progression of the osseous changes. The scaphoid, the cuboid, and the three cuneiform bones now showed advanced periosteal proliferative changes, together with conspicuous "punched-out" areas of destruction throughout. For the first time, periosteal proliferative changes were observed along the proximal half of the first and fifth metatarsals.



2. (Case 1). Appearance when condition was of 7-year duration. Granulomatous swellings and sinuses present.

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There seemed to be a tendency for demarcation, at this stage, in the shafts of the second, third and fourth metatarsal bones, yet there were definite punched-out areas of destruction in the proximal thirds of the shafts of these same metatarsals. The joint spacing between the astragalus and the scaphoid, and the calcaneus and the cuboid bones appeared to remain intact; that is, the articulating surfaces appeared to be smooth and regular throughout. The picture of destruction predominated over that of proliferative changes. The demarcation in the second, third and fourth metatarsals was outstanding.

A biopsy made on 11 June indicated nothing more than chronic osteomyelitis. Incisions were made, drainage was established, and sulfathiazole was applied. Nevertheless the condition progressed and the pain became so intense as to necessitate the use of morphine. At this time the diagnosis of Madura foot was established by laboratory methods.

Treatment.—At first courses of treatment were instituted comprising sulfathiazole, roentgen rays, and large doses of potassium iodide, but without any appreciable improvement. Penicillin was then resorted to, beginning on 9 November, when the entire foot was swollen and bluish-red. There were numerous scars which resulted from the healing of previous sinuses, together with a few sinuses that were still discharging abundant watery pus. Several small, elevated, and fluctuating nodules evidently represented the subcutaneous granulomas of this disease. One of them was incised and yielded cheesy, blood-streaked material, together with the grayish-white grains which characterize this (monosporium) form of Madura foot. However the lesion had not progressed to the size of the extreme cases which are met in the Orient.

The first dose of penicillin was 60,000 units, administered intravenously. The average daily dose for the next 22 days was 160,000 units. On the fourth day of treatment, all of the sinuses were incised and thoroughly cleaned. On the tenth day of treatment, the swelling and induration had decreased remarkably, and pain had disappeared. The discharge had decreased and become thinner. On the fourteenth day of treatment, motion of the foot was improved and yet new nodules appeared to be forming at several places. The total dosage of penicillin was 3,700,000 units.

Although there was encouragement in several respects, the prospect of cure was not at all promising in view of the development of fresh lesions, but before proceeding to amputation the patient was discharged on 4 December, 3 days following the last injection of penicillin, for a waiting period. At the end of 1 month he returned surprisingly improved. The foot was greatly reduced in size. Acute inflammatory features had disappeared and the patient was able to bear a certain amount of weight on his foot without appreciable pain.

One month later all the lesions had healed completely and the foot could bear more weight.

When seen on 26 June 1944, the patient was able to walk for a few yards without the aid of a crutch and wanted to go to work. We realized, however, that it was premature to conclude that all of the microorganisms of the disease had been destroyed. It was certain, though, that penicillin had halted the progress of the disease. It had caused cessation of pain, reduced the original swelling, and at least temporarily healed all of the sinuses.

An x-ray examination on 14 June indicated that the bones were participating in the improvement. There was notable recession in general of all evidences of periosteal proliferative changes. Increased lime salt deposit appeared to be present throughout the demarcated lesion; i. e., as it involved the proximal ends and shafts of the metatarsals and the three cuneiform bones, the scaphoid, and

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the cuboid bones. There still appeared, however, to be punched-out areas of demineralization in the distal third of the calcaneus, yet periosteal proliferative changes were absent. Again the picture of demarcation was conspicuous. The radiographic impression was that there had been considerable absorption of the products of osseous destruction.



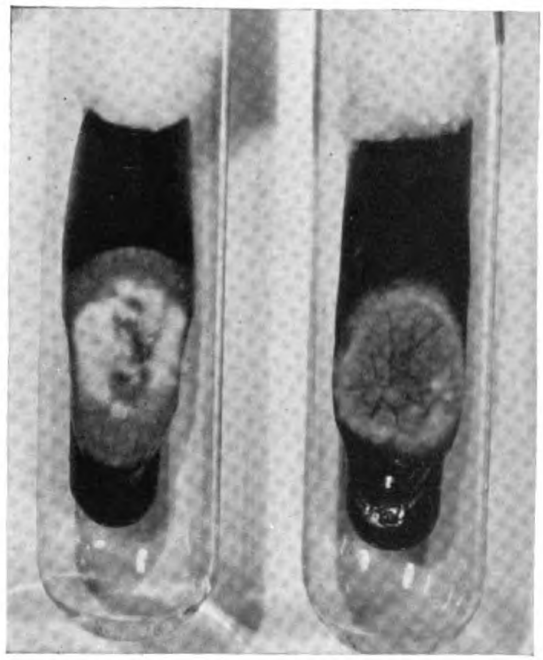
3. (Case 1). Six months after instituting penicillin therapy.

Fifth admission.—In August, only 2 months after he had appeared to be cured, the patient returned because of a severe, acute exacerbation. The entire foot was intensely swollen, extremely painful, and covered by numerous new sinuses together with old ones that were again exudative. Cultures were made from pus, and Monosporium apiospermum was again identified. No surgical procedures were undertaken. Penicillin was again administered, and after 2,100,000 units had been employed there was no objective improvement; however discomfort and pain were relieved. Considering the extreme osseous destruction and the second failure with penicillin, the foot was amputated on 26 October.

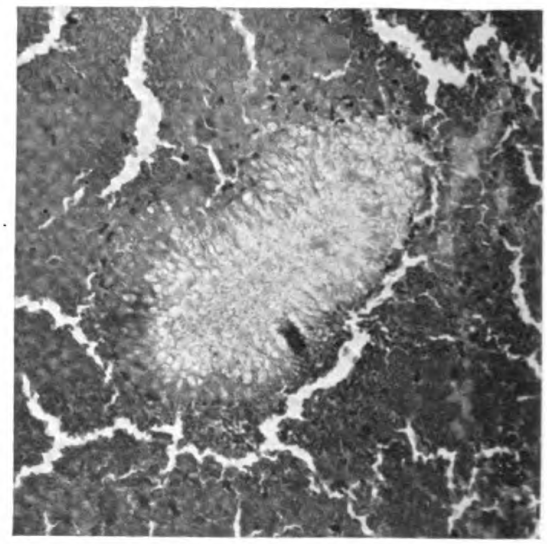
Histologic examination.—The specimen submitted was not ample for satisfactory evaluation of representative tissue changes. Most of it consisted of blood and necrotic fibrous tissue, interspersed with smaller or larger areas of leukocytic infiltration. Definite granulomas were not discoverable, but at several places there were areas of diffusely distributed and degenerated epithelioid cells. Within two localized aggregations of leukocytes the special fungus structures appeared which constitute the well-known "grains" of Madura foot. One was so necrotic as to defy analysis of its structure. The other was better, but so small that it could not be identified grossly and must have represented a young form. It measured 0.7 mm. in diameter.

It was somewhat dumbbell in shape, with an even, rounded contour and a slightly pebbled surface. This was due to the slightly projecting ends of certain

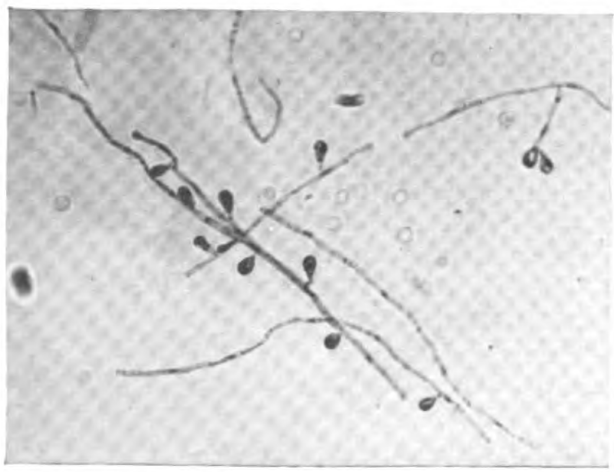
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4. (Case 1). Colonies of Monosporium apiospermum 4 weeks old, growing on Pennsylvania medium. The one on the left is already becoming pleomorphic as shown by the white, cottony formation on the surface. The rest of the colony is delicately powdery and yellowish-brown in color. Colonies in subculture did not repeat these distinctive features; they were cottony in all their parts.



5. (Case 1). (Right) "Grain" in histologic section. The surrounding black material is blood.



6. (Case 1). Monosporium apiospermum in culture. Large spores borne singly but sometimes in pairs; either with or without special conidiophores.

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radially directed, irregularly columnar, hyaloid structures which collectively comprised a fairly thick peripheral zone. There was thus an approach to the architecture of the ray fungus of actinomycosis, except that the rays were far coarser and not definitely club shaped. Moreover the central part of the grain did not exhibit the granular structure of a classic ray fungus; it was composed of comparatively large and vacuolated cells which were presumably the coarse hyphae of this fungus as it grows in tissue. There was not the slightest evidence of pigment in the fungus mass; this is compatible with the fact that the grains observed in the pus were white. In short, the sections excluded a diagnosis of actinomycosis and of those other forms of Madura foot in which the grains that appear in the pus are black. The characteristics of the grain conformed to those found in published descriptions of Monosporium apiospermum.

Cultures.—Materials from pus were planted on Pennsylvania medium, which is an American modification of Sabouraud's test medium. Fungus colonies developed fairly rapidly, becoming 2 cm. in diameter within 3 weeks. The margin was sharp, the texture compact, and the surface delicately granular and of a dirty, brownish-yellow color. Eventually the surface became uneven and developed a few fairly deep radial furrows. Even in the primary plantings, pleomorphism developed rapidly in the form of a white, cottony coating which completely obscured any underlying features that might have been characteristic, and in subcultures the white, cottony growth constituted the entire colony. That is, stock subcultures of our strain did not reveal the distinctive characteristics; the latter were observed only in the primary cultures.

This was found to be true also of a culture of Monosporium apiospermum which was secured from the National Type Culture Collection. When transplanted upon Pennsylvania medium, only the noncharacteristic, white, cottony, pleomorphic colony developed. This culture was examined microscopically for authenticity, and the typical conidial forms of monosporium were found.

In hanging-drop cultures examined under the microscope, the features also conformed to already published descriptions of M. apiospermum. Hyphae were narrow, indistinctly septated, and contained large spherical metachromatic granules. For the most part straight, some were crooked or varicose or both. Goodly portions of the mycelium were of almost hairlike delicacy, tangled and wavy; these features do not appear in other descriptions of this species, but may have been overlooked or be the result of differing cultural environments. The conidia were large, clear or smoky, ovoid, smooth surfaced and double contoured. They were borne singly, either at the tips of hyphae or on short lateral hyphae. They contained two spherical metachromatic granules.

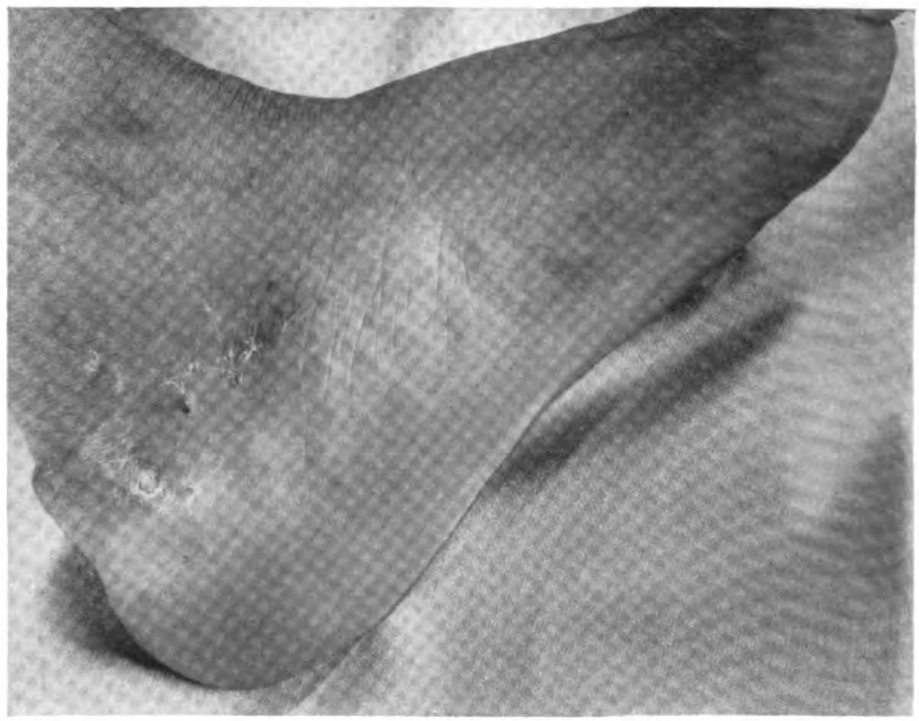
Special search was made for perithecia, containing spores, which Weidman reported in the publication by Jones and Alden (*1*), and the ascocarps which Emmons (*2*) has discussed, but without success. Nor were they discovered in hanging-drop preparations or in histologic sections of test tube cultures which were made in the manner described by Weidman.

Accordingly, as the result of the histologic and culture studies, the fungus in the case can be definitely diagnosed as Monosporium apiospermum. Incidentally Emmons has indicated that this species is identical and synonymous with Allescheria boydii; the latter is the ascocarpic stage of M. apiospermum.

Of the 8 genera and 30 species of fungi which are recorded (*3*) as causing Madura foot, Monosporium apiospermum is one of the less common agents. Up to 1930, only seven cases were found in the literature by Gay and Bigelow (*4*).

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Case 2.—A 40-year-old native-born Filipino, while aboard ship in the Aleutian Islands in 1942, bruised his right heel against a cable. This was followed by a "boil." It healed but recurred three times. In September 1943 the lesion was incised and drained. Although it improved somewhat, there was still considerable discomfort, especially during and after exercise.



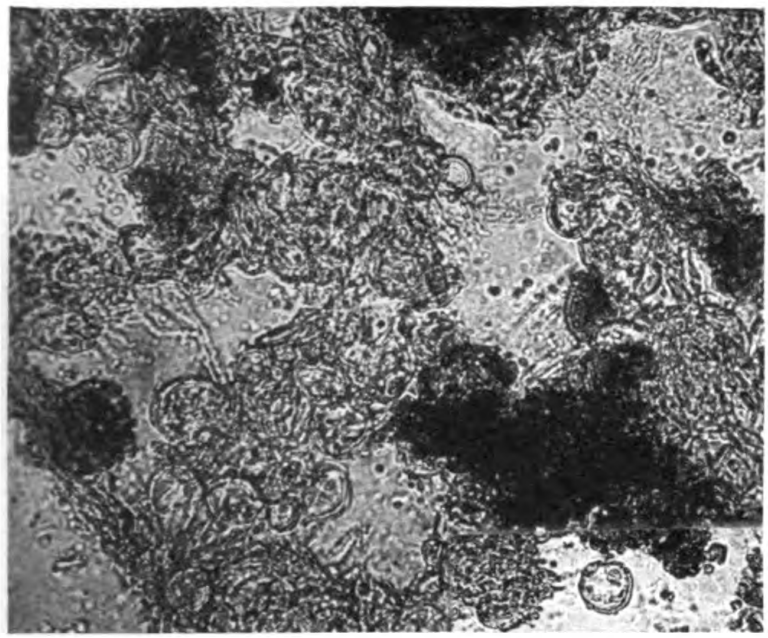
7. (Case 2). Appearance of foot on admission to the hospital.

When he was seen at the Naval hospital on 6 March 1944, no essential abnormalities were found on physical examination except an area on the inside of the left heel. Here there was a scar about 6 cm. in length, and on either side of it there were several healed lesions. Posteriorly there was a soft, fluctuating, tender nodule. Two similar but smaller nodules could be palpated above and below the scar. The entire region was moderately swollen, but there were no sinuses. In view of our experience in the preceding case, Madura foot was suspected.

Routine laboratory examination, including blood counts, urinalyses and Kahn blood test, yielded negative findings. Similarly, x-ray studies disclosed no evidence of osseous involvement. On 24 April, one of the nodules was completely excised under spinal anesthesia and the strictest of aseptic conditions. Scrapings from the cut surface contained purulent material and black granules. The specimen was subjected to bacteriologic, mycologic, and histologic examinations. Immediately following this, all other nodules were incised and curetted.

Histologic findings.—These were not at all characteristic for Madura foot, inasmuch as fungous substance was not included in the sample of skin submitted. Deep in the corium there was a sharply outlined region of inflammatory round cell infiltration, and nearby there were one or two smaller areas. The large one consisted of a rather highly vascular stroma of loose, young, fibrocellular tissue, richly infiltrated by inflammatory round cells, mostly plasma cells and

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8. (Case 2). Portion of black "grain" from cut surface of biopsy specimen as seen microscopically. The double contour on the chlamydospores is indicated by arrows. Others of these spores are so degenerate and distorted that the details of their original structure can no longer be recognized. The spore in the lower right-hand corner has been inserted from another photograph. These cells appear to be similar to the hulle cells which appear in cultures of certain aspergilli.

lymphocytes. Polymorphonuclears occurred, but never in sufficient numbers to indicate actual pus production. Epithelioid cells could be discovered only upon careful search; they were sparingly distributed and intermixed with the other kinds of cells. Giant cells were not observed. Nowhere was there a sufficient focalization of any special kind of cell to permit the recognition of miliary lesions.

Bacteriologic and mycologic findings.—Inasmuch as it had been questioned (*5*) whether the fungi in Madura foot are always the causative agents and suggested that bacteria are the culpable ones, particular pains were taken to test for bacteria in the material excised. Cultures were made for bacteria both aerobically and anaerobically, including blood agar, but none grew under any circumstances. Thus it appears that the fungus which was isolated is the valid cause in this case, particularly since similar structures (chlamydospores) were found both in the grain and in blood agar cultures.

One of the black granules from tissue scrapings was crushed under a coverslip and mounted in normal salt solution. It was found to consist almost entirely of dark, golden-brown fungous elements. These appeared in the form of closely packed agglomerations of chlamydospores with but few hyphae. Most of the chlamydospores were large, flattened on one or more sides, puckered and otherwise deformed, and appeared to be dead. Their walls were so thick that at times they encroached upon the interior of the spore to the extent that little of the cytoplasm was represented; sometimes they were faintly, concentrically striated. At most only a few granules appeared in the interior, together with a round, hyaloid body.

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In most cells the thickness of the wall varied within a single cell, being so thin at one place as to suggest that the cell would rupture easily. Most of them were mere shells, without any recognizable internal structures. There was not the slightest tendency toward fusion of the chlamydospores, such as occurs in the formation of *organes nodulaires* and sclerotia formation. Nor could any special arrangement of the grain into zones, such as appears in infections by Madurella mycetomi, be recognized, but it should be remembered that this was a crushed specimen.

The hyphal elements were so highly degenerate that their original characters could not be established. It was clear that the black grains consisted almost solidly of large, brown chlamydospores which were old and degenerate.

Cultures.—Upon Pennsylvania medium kept at room temperature, the colonies grew rapidly. Within 1 week they were 1 cm. in diameter, thin, flat, and grayish-white. The surface was delicately granular, like ground glass. From the margins, short, delicate radiations extended for 1 or 2 millimeters. In 3 weeks the colony was 2 cm. in diameter, the gray color had deepened, and a granular or crumbly disk had developed in the center; a peripheral zone was now moist, smooth, and exhibited a few radial furrows. At the end of 2 months, parts of the colony were brown and the surface had become elevated into sharp folds in the center, but elsewhere the colony was still flat and exceedingly thin. Everywhere it was moist or waxy. Eventually after several months coalescent tufts or spicules of white, cottony mycelium projected upward from the surface in the center of the colony (coremia).

Miscroscopic appearance of the fungus.—In hanging-drop cultures of glucose bouillon kept at room temperature, the characters of cephalosporium appeared, such as are represented for this genus by Dodge (*6*). The details of structure will be published shortly as for a new species which has been named Cephalosporium granulomatis, Weidman and Kligman. It is not Cephalosporium recifei, which is the only species of cephalosporium that was recorded by Brumpt as a cause of Madura foot, nor is it the unnamed species of Carrion (7).

After standing in the laboratory for several weeks, the original crush preparation of the black grain was re-examined, and it was now found that mycelium had grown from some of the chlamydospores. It appeared in two forms. The one was composed of nondistinctive, broad hyphae with sharp, heavy septa such as appear in aspergillus and other well-known molds. Branches were short and had rounded ends. The cytoplasm was dark brown, hyaloid, and appeared dense. It did not contain granules. A few hyphae were discovered which were septated, in which case the segments contained one or several large, rounded, clear structures which might possibly represent fat or beginning arthrospore formation or both. In short, this brown mycelium could be reasonably reconciled with the brown arthrospores and may be assumed to be the form which mycelium would take if it grew in the lesion.

In view of these discrepancies between the features in the grains and the hanging-drop preparations, particularly the absence of chlamydospores in the latter, it was thought at first that the cephalosporium diagnosed in the hanging-drop preparation was a contaminant and not the causative agent of the disease. As a check, then, cultures were grown upon blood agar at 37.5° centigrade. This resulted in colonies with an entirely different appearance from the ones grown at room temperature on Pennsylvania medium, and forms were now found microscopically which were quite compatible with those in the black grains from the lesion. Thus although mycelium dominated the picture, numerous chlamydospores were also present which conformed closely to those in the grains.

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It seems reasonable, therefore, to conclude that this cephalosporium is the cause of this case of Madura foot.

As a matter of record, the colonies which were grown upon blood agar at 37.5° C. appeared as follows. At the end of 10 days they differed radically from the ones previously secured. Obviously, growth was highly retarded. The colony was only from 6 to 8 millimeters in diameter. It had sharp, irregularly lobulated outlines and was so highly elevated (3 or 4 mm.) above the level of the agar that the colony appeared as a lump. Its consistency was compact. With its pale, grayish-brown color, and a somewhat moist appearance, it resembled wax. The surface was lumpy or vermicular, and in some colonies a delicate, gray, powdery deposit more or less obscured the browner, waxier parts underneath. These powdery features prevailed at the upper portions of the agar slant where the medium was thinner and drier and where growth conditions were therefore more adverse. There was a striking resemblance to Achorion schoenleinii except that growth was somewhat more rapid.

Treatment.—Penicillin therapy was instituted the day following biopsy. It consisted of 20,000 units every 3 hours until a total of 2,300,000 units had been administered. Within 4 weeks all of the incised lesions around the biopsy wound had completely healed, but the wound itself required 2 more weeks of treatment with sterile dressings. The patient was discharged to full duty 6 weeks after completion of the penicillin treatment.

COMMENT

Although the bones had not yet become involved in the second case reported here, both cases may be classified as Madura foot largely because of the "grains" developing in the tissue and pus. Features common to both were their occurrence in foreign-born males, and that the lesions developed outside the tropics. In other respects, however, they differed as follows.

In case 1, the disease was of 7 years' duration, and had led to extensive destruction of bone; in case 2, it had been present for only 2 years and was confined, apparently, to skin and subcutaneous tissues. The causative microorganism was different in the two cases, and the ages of the patients differed widely. Judged by the experience with penicillin in case 1, with apparent cure for 8 months, it would be premature to claim that there was also a difference in the efficacy of penicillin therapy in the two cases; there is still time for the patient cited in case 2 to suffer a relapse. It is similarly premature to conclude that the difference in therapeutic result can be explained on the basis of the different causative microorganism.

One conclusion is permissible; namely, that penicillin as currently employed is not invariably curative for Madura foot. It can, though, at least ameliorate the disease in a prompt and spectacular manner. In case 1, although the lesions at the final admission to the hospital remained uninfluenced, pain was completely relieved. Incidentally, these considerations have a striking parallelism with results that have accumulated in a similarly small way for actinomycosis (*8*) (*9*) (*10*) which has many features in common, both clinically and patholog-

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ically, with Madura foot. In fact, Actinomyces bovis is numbered among the microorganisms which can cause Madura foot.

In short, although the story of penicillin therapy is only beginning, it appears that a group of fungus diseases may be developing, in which the value of penicillin is equivocal, at least as currently employed.

SUMMARY AND CONCLUSIONS

1. Two cases of Madura foot are reported. Both occurred in foreign-born persons, yet the disease was contracted outside the tropics (Philadelphia and Alaska).

2. Both of the fungus species concerned were among the rarer causes of Madura foot; Monosporium apiospermum and Cephalosporium granulomatis.

3. Results of penicillin therapy differed in both cases. In the first case the disease had progressed to the development of osteomyelitis, and although an apparent cure was achieved at first in a most spectacular manner, the disease relapsed and amputation had to be resorted to, even though the penicillin was administered over a relatively long period (27 days). The patient was an elderly man. In the second case, which concerned a young Filipino sailor, only the soft tissues were involved, and at the end of 8 months the cure appears to be permanent.

4. Attention is called in the first case to the discrepancies in the symptoms that appeared late during the unusually long administration of penicillin; i. e., old lesions regressing but new ones appearing. This seems to speak for a wavering period in the therapeutic effect, with the scales finally turning favorably after discontinuance of treatment. No explanation for this can be made, particularly in view of the rapidity with which penicillin is ordinarily excreted.

5. Although there appears to be a parallelism between Madura foot and actinomycosis in regard to the possible value of penicillin therapy, such a generalization cannot be made with finality at the present time. Certainly it cannot be made to include the entire group of deep mycoses, in view of the recalcitrance of coccidioidal granuloma and blastomycosis which has been rather uniformly reported for these conditions. Indeed it is scarcely reasonable to expect penicillin to be uniformly efficacious in Madura foot, because the condition is only a clinical entity: in it no less than 8 genera and 30 species of fungi have been listed (Brumpt). On the face of it, the value of the biologic product, penicillin, should depend on the causative agents in the individual case rather than on human anatomy and the production of grains; the latter two features are wholly artificial (biologically speaking) factors, and cannot logically be reconciled with the value of penicillin. This emphasizes the necessity for precise mycologic determinations in future studies of the value of penicillin in Madura foot in general.

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BACTERICIDAL EFFECT OF ETHER

Ether is quite ineffective as a sterilizing agent for the skin, since its effect is very slight on staphylococci and streptococci when applied to a surface—though it is effective against certain bacillary forms, both gram-positive and gram-negative.—ARCHER, G. T. L.: Bactericidal effect of mixtures of ethyl alcohol and water. Brit. M. J. 2: 148–151, August 4, 1945.

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NICOTINAMIDE FOR ATROPHY OF TONGUE

Treatment with 50-mg. doses of nicotinamide brought about striking improvement in a large group of patients having atrophy of the tongue, including fissures. It reduced also the number of filiform papillae and dental scalloping. Treatment was most complete in the case of the papillae but was also noticeable in the shallower fissures, and it markedly decreased the amount of scalloping.—SEVRINGHAUS, E. L., and KYHOS, E. D.: Reversal of lingual atrophic changes with nicotinamide therapy. Arch. Int. Med. 76: 31–33, July 1945.

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DENTINOGENESIS IMPERFECTA

REPORT OF A CASE

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Lieutenant (DC) U. S. N. R.

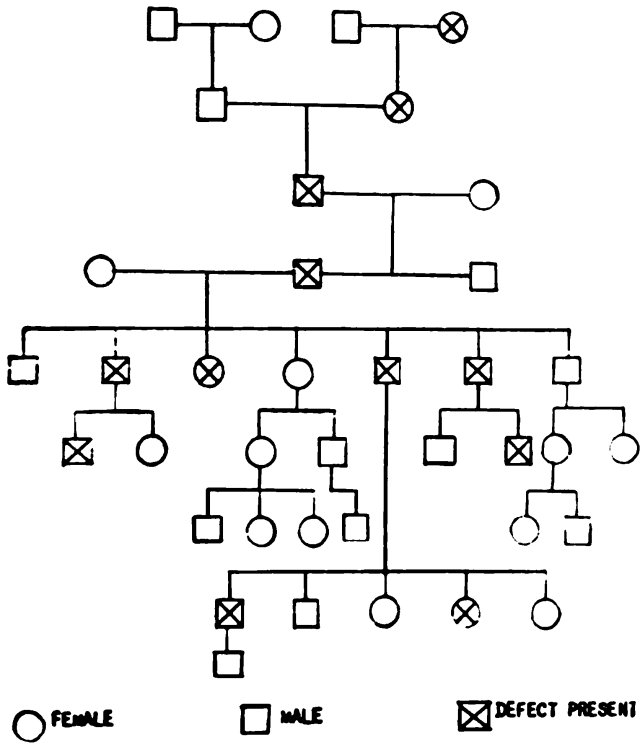
In the course of a routine dental examination of Seabees leaving for a foreign base, an unusual case of dentinogenesis imperfecta was seen. The 30-year-old patient was well aware of the defect and was able to trace its occurrence in his family for the past seven generations. He knew the condition only as "brown teeth," as those of his family similarly affected had termed it. The patient had no other apparent defects of mesenchymal origin, such as are often found in cases of dentinogenesis imperfecta. The defect will invariably show in osteogenesis imperfecta, but no evidence of this disease was found. The hypoplasia was noted in the deciduous as well as in the permanent teeth.

The hereditary nature of the disease is evident from the genealogy chart (fig. 1). The chart covers seven generations and illustrates the fact that the condition is not shown in the children unless it is visibly possessed by one of the parents; it is therefore a dominant characteristic with a ratio of 1:1 to be expected in the offspring. Such a ratio has been followed very closely in this family, especially so in the fifth generation. The defect had never been noted in any other family of the township, eliminating the water supply as a possible etiologic factor. Furthermore the defect continued to appear even though the family moved to an entirely new locality. The hereditary pattern followed in the permanent teeth shows up equally well in the deciduous dentition.

Case report.—Oral examination of the patient revealed an extreme prognathism (figs. 2 and 3). All of the teeth except some of the molars showed excessive wear, and some, namely, the upper and lower bicuspids, were worn down to the gingival border. The enamel was friable and extremely thin. It separated easily from the teeth and was straw-yellow in color. The dentine was highly polished, with an enamel-like smoothness. Not all of the teeth were equally involved and those which were not affected (the upper right third molar, the upper left third molar, and the lower right and left second and third molars) showed normal anatomic configuration but had a bluish tinge.

There was no evidence of salivary calculus, and no progressive caries was noted. The patient stated that originally the enamel was of normal amount, although brown in color, but that it seemed to wear away almost immediately after eruption of the teeth. He had a vivid memory of having "a mouthful of

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1. Genealogy chart of a family with an inherited defect of dentine. This characteristic is dominant and will not show in the children unless possessed by one of the parents.

sand" one day after he had struck his head on that of another player in a football game. Although large pieces of enamel had been chipped off, he had had no sensation of pain.

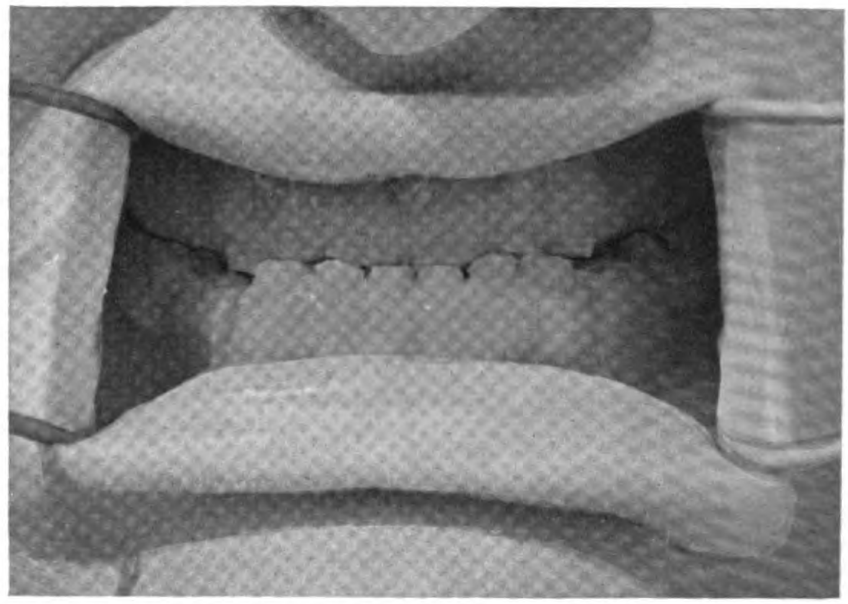
The gingiva was normal and healthy. The torus mandibularis was prominent and the buccal aspect of the alveolar bone was pronounced.

Figure 4 shows the loss of vertical dimension caused by excessive wear, as evidenced by the flat, thin lip line, the prognathic appearance, and the deep nasolabial furrow.

Roentgenographic examination revealed the roots to be short and blunted at their apexes. Even those of the molars, which are not apparently affected by the defect, gave the appearance of being foreshortened. The pulp chambers were entirely obliterated and the pulp canals, when present, were of narrower diameter than normal. The teeth were widely spaced, having been worn down past their widest mesiodistal diameter, yet the crests of the alveolar interdental bone were high and well formed. The alveolar bone was compact and the trabeculation normal. The peridental membrane was normal, the lamina dura dense. There was no evidence of active caries. Amalgam restorations noted on the molars were placed early in the patient's life, in an attempt to retard the destruction. When they were placed, the patient had no sensation of pain.

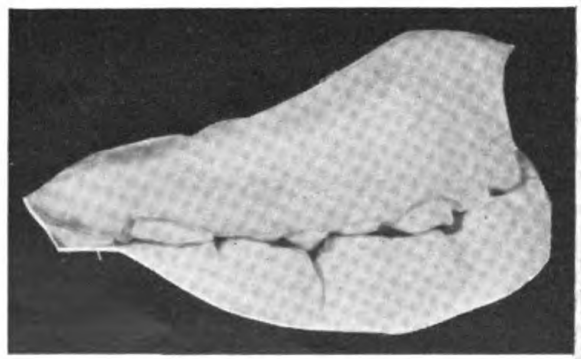
Inevitably the end result must be full or partial dentures. The patient reported that his father had had all his teeth removed, when at 12 years of age he was convinced by the past experience of his own father of this necessity. The patient's sister had a partial denture made to restore the anterior teeth for

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2. The teeth in centric occlusion, showing the extreme prognathism and the attrition of the anterior teeth.

3. Right lateral view of study cast.





4. (Right) Profile view of patient showing the loss in vertical dimension.

esthetic reasons. The patient himself feels that he is maintaining adequate masticatory function, and his excellent physical condition eloquently bears out his statement, therefore treatment at this time is not considered warranted.

According to Wilson and Steinbrecher (*1*) who examined two such affected teeth histologically, the enamel differs only slightly from normal. The pulp chamber is absent and there appears to be an almost total absence of dentinal canals in the labial and lingual aspects of the cervical area. The dentinal tubules, when present, are irregular in size and in direction, some being quite bulbous and appearing more like pulpal inclusions than dentine tubules. Interglobular spaces are numerous.

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A high-power photomicrograph, which they have reproduced, shows the giant dentinal canals and tuft formation. These investigators surmised that these canals probably contain nerve, lymph, and blood supply to the dentine. By means of the benzidine test, they proved that blood was present in the dentine. The discoloration of the dentine, then, would correspond to that often seen following a traumatic injury to the tooth. Therefore they theorize that there is a blood supply in these teeth not only in the pulp, but into the dentine as well. The defect thus involves not only a hypoplasia of the root, and a dystrophy of the structural arrangement of the dentine, but also a disarrangement of the circulatory supply of the teeth.

Roberts and Schour's (*2*) conclusions amplify the foregoing observation by stating that the enamel structure is normal, and that the mantle dentine nearest the enamel is normal but the circumpulpar dentine is atypical in that it is characterized by (1) irregular tubule arrangement; (2) a smaller number of tubuli than normal; (3) occasional larger diameter of the tubuli with cellular inclusions; (4) numerous branchings of the tubules; (5) accentuated incremental stratification of the dentine matrix; (6) poor calcification; (7) the pulp cavity greatly diminished in size and filled with atypical dentine; and (8) no odontoblasts noted.

Hodge (*3*) reported a high water content, from 15 to 20 percent instead of the normal 8 to 10 percent, and a low inorganic content, from 70 to 75 percent instead of the normal 80 to 85 percent. Calcium, phosphorus, and carbon dioxide ash content were essentially normal. These findings were corroborated by Skillen (*4*).

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MORTALITY FROM SYPHILIS

In the individual patient who has received adequate treatment and in whom physical examination and spinal fluid examination show no abnormalities, the chance of death as a result of syphilis is minimal.—Schamberg, L. I.: Prognosis of syphilis; critical review of clinical, autopsy, and life insurance studies. Am. J. Syph., Gonor. & Ven. Dis. 29: 529–550, September 1945.

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ACUTE ATABRINE INTOXICATION

REPORT OF A CASE

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In the light of widespread belief that atabrine is a dangerous drug, the meagerness of reports on its toxicity is surprising. In studies on growing rats, Wright and Lillie (*1*) found that a high dosage of atabrine (30 milligrams per kilogram) over a long period of time produced minor, reversible, degenerative changes and pigment cell infiltration in the heart, liver, kidneys, lungs, spleen, and intestine. Higher dosage, near the limit of tolerance for a similar period, caused arrested growth, emaciation, liver infarction, cirrhosis and infiltration, focal myocarditis in the wall of the left ventricle, glomerular kidney degeneration, interstitial and alveolar pneumonitis, widespread pigment cell infiltration into lymphoid tissues, and generalized yellow staining of all tissues.

Similar findings were reported by Martin, Cominole, and Clark (*2*). Sollman (*3*) noted, in addition, central nervous system symptoms preceding death. He states that dosage of one-third the minimum fatal dose for 14 days produced hepatic impairment, but that dosage of one-sixth the minimum fatal dose for 6 weeks did not. In acutely intoxicated rabbits and cats, Hecht (*4*) noted enteritis, staining of the intestines, and liver hyperemia.

Bispham (*5*) reviewed all toxic reactions reported from the clinical use of atabrine up to November 1940. In 49,681 cases there were 38 severe toxic reactions, which disappeared on withdrawal of the drug. These were severe headache, abdominal pain, vomiting, diarrhea, mental depression, and psychoses. Blackwater fever was reported after small doses as has been the case in connection with quinine therapy. During 14 years in the tropics, and more particularly in a 2-year series of 30,000 cases treated with atabrine, Dove (*6*) noted no cases of alarming reactions. A report of the Surgeon General of the Army in September 1943 (*7*) mentions that in a few instances hepatic disease may have been associated with atabrine in therapeutic doses, whereas suppressive doses had been taken by several groups for a year or more without known lasting untoward effects.

Sollman states, without giving the source, that cases of acute collapse and death have been reported, usually following intravenous use of the drug. It is generally accepted that therapeutic doses of

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atabrine produce a small percentage of minor symptoms, mainly headache, abdominal pain, vomiting, and diarrhea, most of which disappear even without withdrawal of the drug. Central nervous system symptoms, from minor irritability to excitement, delirium and psychoses, have been uncommon and often loosely attributed to atabrine therapy. There is apparently no record of an autopsy in a case of death from atabrine.

By taking a huge dose of atabrine in an unsuccessful suicidal attempt, a patient recently created a rare opportunity to observe acute atabrine intoxication.

Case report.—The patient, a 24-year-old Navy enlisted man, had been hospitalized because of chronic low back pain which allegedly began upon his entry into the service. There was a history of an undiagnosed, feverish illness in infancy, childhood difficulty with his legs, and a lifelong rolling gait. He was found to have diminution of the normal lumbar curve. The left lower extremity had a smaller circumference than the right, with slightly greater deep tendon reflexes. All other findings, including x-ray and cerebrospinal fluid examinations, were normal.

Attempts at treatment by means of postural exercises and physiotherapy met with no cooperation and no success. It was decided that he had a residuum of an infantile hemiplegia. A further trial at duty was recommended, and the patient was so informed.

Sometime in the midafternoon of 3 April 1944, he took an undetermined amount of atabrine in tablets of 1½ grains. He washed the tablets down with a bottle of Coca-Cola, taking about four or more tablets with each sip. At least 90 grains were probably ingested, the exact amount being unimportant in the light of the vomiting that followed. Within 2 hours he noted dizziness and blurring of vision, and at that point became amnesic.

At 1900 he had a convulsion consisting of bizarre tossing of his arms and kicking of his legs. Examination shortly afterward revealed him to be stuporous, responding only dully to stimuli. His face was flushed, his extremities pale, cold and moist. The pupils were dilated but reacted normally to light. His pulse rate was 90, thready and weak; blood pressure was 78/60. His extremities were flaccid, but deep tendon reflexes were active and equal. He had vomited, and continued to retch and vomit yellow, slightly blood streaked, mucoid vomitus. This was inadvertently tasted by a medical officer and found to match closely the bitter taste of atabrine.

Thorough gastric lavage was performed at once and 1,000 cc. of 5-percent dextrose in saline solution was administered intravenously. The patient's state of collapse improved during the next 12 hours, with recovery of the blood pressure and improvement in the pulse rate. He remained stuporous but restless, with clonic twitching of the extremities and facial musculature, and picking at his face and body. There was incontinence of urine and feces. There was a suggestion of trismus and nuchal stiffness. Deep tendon reflexes at this time were absent, except for active triceps jerks; the neurologic findings were otherwise normal. Cyanosis developed, with generalized pulmonary rhonchi and small, moist râles in both bases. There was some dehydration. His skin had become greenish yellow, deeper streaks showing the courses of the saphenous veins. There was no discoloration of the sclerae, but his tears, urine, and perspiration were all colored, and his bath water had a heavy, jelly-like, deep green precipitate.

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By 24 hours after ingestion of the atabrine he was more alert and nodded in response to some questions but was still mute. He was getting oxygen by nasal catheter and had been given 4 liters of 5-percent dextrose in normal saline solution. The urine contained a trace of albumin and 2-plus sugar, but was otherwise not remarkable. There was slight hemoconcentration, with an erythrocyte count of 4,720,000 and a hematocrit reading of forty-eight. The leukocyte count was 16,300 with 4 percent lymphocytes, 4 percent monocytes, 18 percent immature forms and 74 percent polymorphonuclear leukocytes. The icteric index was 13.5 units. Clonic twitchings had ceased, but restlessness and dribbling of urine continued. The skin discoloration continued to deepen.

Within 48 hours of taking the atabrine the patient was conscious, able to give a history, and was taking fluids by mouth. He complained of nausea, generalized headache, and pain in the epigastrium and the right lower part of the chest. He had a loose cough productive of yellow mucoid sputum. Neurologic examination showed the responses to be normal. He had received a total of 8 liters of dextrose in saline solution by infusion. Infusions and oxygen were discontinued, and he was given 1 ounce of brewer's yeast daily. At about this time yellow discoloration of the sclerae was first noted.

Recovery was rapid and complete. The cough disappeared without development of pneumonia. The leukocyte count fell to 12,500 on the second day, to 10,300 on the third day, and was 8,850 on the twelfth day, with the differential count restored to normal. The icterus index fell to 7.5 units by the end of 2 weeks, but yellow skin discoloration was still evident at the end of a month. At no time could the liver or spleen be palpated.

No evidence of liver damage was found. When the icterus index was highest, the qualitative van den Bergh test was negative. Blood urea nitrogen determinations were 19.9 milligrams on the first day and 20 milligrams on the third day. At this time the blood cholesterol was 235 milligrams and the prothrombin time was 50 percent of normal. On the sixth day a hippuric acid test showed a total benzoic acid excretion of 4.26 grams. When repeated at the end of 5 and 6 weeks the excretions were 2.65 gm. and 3.43 gm. respectively.

One atabrine blood level determination was done, on the second day, at the laboratory of the Letterman General Hospital. This proved to be 475 gammas, 25 gammas below the maximum carrying capacity of the blood, and the highest level encountered up to that time at that laboratory.

PSYCHIATRIC ASPECT

This case is of psychiatric interest mainly for the light it throws on the motivation for certain suicides. It is only when such attempts fail, and the person himself is available for study, that there can be a reconstruction of the motive which is not highly conjectural.

This man had a lifelong history, confirmed by his mother, of emotional instability. His interests and aims were highly self-centered. He displayed little warmth toward others and was not gregarious. Frequently when thwarted he had outbursts of violent hostility, easily provoked by real or fancied slights and injuries. Throughout childhood these outbursts took the form of temper tantrums in which he threw himself onto the floor, screaming and kicking. When older he replaced the tantrums by pouting and sulking and spitefulness when angry. Only once did these fits of temper

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lead to violence directed outwardly against the person who angered him.

He resented being inducted into the Navy because of the good job, the automobile, and the other comforts which he was forced to leave. He found the service oppressive and frustrating because of its discipline, his lowly status, and forced close association with many men. The decision to return him to duty was a disappointment, as he had been anticipating a medical discharge. It made him extremely angry. As he put it, "I figured I was getting a rotten deal. I decided I was going to get out of the Navy if I had to go out in a box." He took a bottle of pills from the nurse's station and swallowed its contents while still in a rage, without knowing what the pills were or what they might do to him.

This suicidal attempt, then, was an angry, spiteful gesture. Like his earlier temper tantrums, it was an act of impotent hostility which he could not express in outwardly directed violence. It was similar in motivation to the behavior of a child who holds its breath until it becomes cyanotic, or who says when crossed, "I'll get sick and die and then you will be sorry." In this way, injury to himself was seen as punishment of his doctors, who would be remorseful for what they had driven him to do.

Despite the fact that suicide was only considered a possibility by the patient, and not expressly intended, it would have been considered a suicide if death had resulted. There are strong indications, from similar cases which we have seen, that many suicides of young people come about as a result of hostility misdirected in just this way. This patient was discharged from the service with the diagnosis of constitutional psychopathic state, emotional instability.

SUMMARY

A case is described in which acute intoxication by a single dose of more than 90 grains of atabrine resulted in complete recovery without apparent liver damage.

The patient's suicidal motivation is discussed from the psychiatric viewpoint as representative of a considerable group of suicides.

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EFFECT OF THYROIDECTOMY ON ULCER

Experimental hypothyroidism is known to produce a decided increase in volume of gastric juice and a less marked, but nevertheless demonstrable, increase of acidity. For this reason, the dogs in this series of experiments were observed for a period varying from 49 to 74 days following total thyroidectomy but before duodenal drainage. It is interesting that in no case did a gastric or duodenal ulcer develop.

On the other hand, total thyroidectomy does seem to modify the character of the peptic ulcer resulting from the employment of the Mann and Williamson operation. As compared with observations in other studies, the ulcers are definitely more chronic, the craters being larger and deeper, and the period of survival of the dog is longer. One is tempted to speculate whether the differences might not be due in a large measure to the excessive body weight resulting from total thyroidectomy. Mann has pointed out, however, that the absolute and percentage loss of body weight in this series of experiments not only is greater, but also occurs more rapidly than usual.

Against this background of experimental evidence, it seems difficult to understand the basis of the clinical observation that, in dealing with a patient who suffers concomitantly from hyperthyroidism and a peptic ulcer, subtotal thyroidectomy often ameliorates the symptoms due to the ulcer. However one must admit that the abolition of hyperthyroidism does not necessarily mean the installation of a hypothyroid state. In other words there is a rather wide range of normalcy in the activity of the thyroid gland.

The results of this study indirectly lend emphasis to gastric acidity as being the most important factor in the pathogenesis of peptic ulcer. Total thyroidectomy, although it leaves lethargy in its wake, has nothing to recommend it as a therapeutic measure for the disease.—WU, P. P. T.: Effect of total thyroidectomy on experimental production of peptic ulcer. Surgery 18: 619–622, November 1945.

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SURGICAL METHOD OF TREATING TROPICAL ULCER

RALPH E. SCOVEL
Commander (MC) U. S. N. R.

"Tropical ulcer" still presents a real problem in the overseas hospitals. Many hospital days are consumed and recurrence is frequent. This is due in main to two factors. First, because of the mixture of organisms found in this type of ulcer, it has been common practice in the past to treat it with a great variety of chemicals. Soaks, ointments, and powders have been applied. Too often chemical trauma, or further contamination, or both, resulted because of frequent dressings. Hence the lesion became chronic. Second, frequently in cases in which the lesion has appeared to be healed, the patients have been sent back to duty with an epithelial covering over the old ulcer site, this covering too delicate to withstand ordinary trauma.

The following method of treatment was found successful in a small series of cases.

On admission and after routine cleansing of the extremity, a powder consisting of 50-percent zinc peroxide and 25-percent each of microcrystalline sulfanilamide and sulfathiazole is applied to the ulcer in generous amounts and covered with a dry dressing. This powder mixture is capable of action against a wide variety of organisms, both aerobic and anaerobic. On the following day the ulcer site is cleansed by irrigation with normal saline solution and is redressed with the powder. This procedure is repeated on 4 consecutive days. Copious suppuration and a deepening of the ulcer crater will be noted as a result of the action of the zinc peroxide.

After five such daily dressings, the patient is sent to surgery where, under strict aseptic technic the extremity, with 12-inch margins on either side of the ulcer, is given a thorough surgical preparation, and the ulcer irrigated with copious amounts of warm sterile normal saline solution. It is then dressed with sterile gauze soaked in normal saline solution.

A large, snug dressing is applied with an inlying Dakin's tube, one end of which is separated from the ulcer by a half dozen thicknesses of gauze, the other end remaining outside the dressing, and capped with sterile gauze. The whole is then covered with cellophane or wax paper and towels. The dressing is kept moist by daily injections of 30 cc. of sterile normal saline solution through the Dakin's

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tube, care being taken not to contaminate the external end of the tube. This is done for 8 consecutive days, at which time a donor site for pinch grafts is chosen, given a preoperative preparation and covered with sterile towels.

On the following day the patient is sent to surgery where the dressings are removed under strict aseptic technic. Healthy granulations will be seen filling the ulcer crater up to the skin level. The granulations are gently lavaged with warm sterile normal saline solution and the surrounding skin area is cleansed and prepared. No chemical antiseptic is allowed to contact the granulations. Pinch grafts from the donor site are then applied to the granulated area. This grafted area is covered with sterile perforated cellophane and a large dry gauze dressing is applied. The dressing should be anchored above and below to prevent slipping. The patient is restricted to bed for 10 days, at the end of which time the dressings are removed. Complete, firm epithelization should result and the patient should be ready for duty.

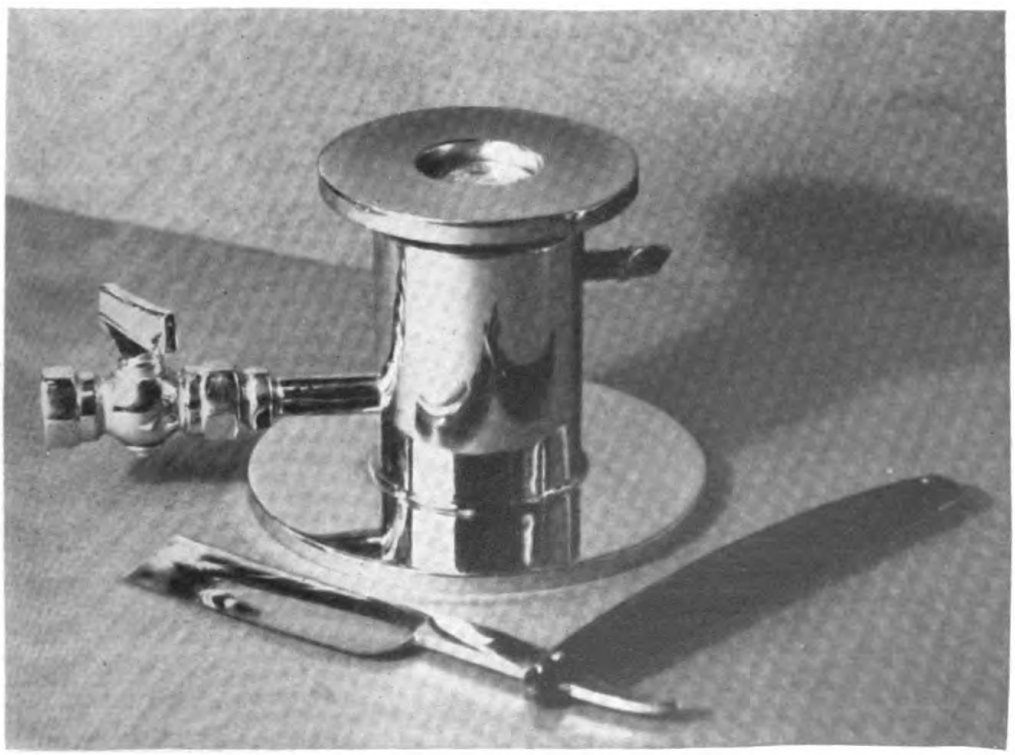
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MEDICAL AND SURGICAL DEVICES

A SIMPLE MICROTOME FOR USE ABOARD SHIP

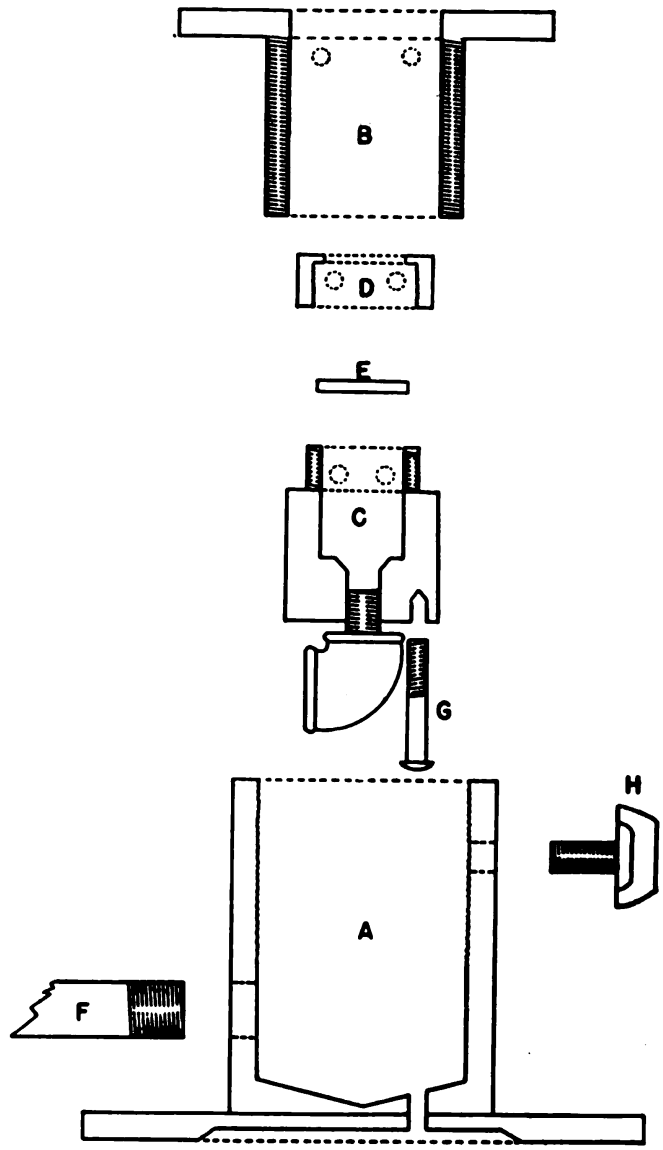
JOHN J. RUPP
Captain (MC) U. S. N. R.
and
O. KOSOBUD, JR.
Pharmacist Mate, third class, U. S. N. R.

A microtome for sectioning frozen tissues can be constructed simply as follows: The lower portion (A) is an upright tube 2⅝ inches long, having an internal diameter of 1½ inches, mounted on a suitable base. The interior of this tube is threaded to admit the upper portion of the microtome (B), which is a tube 1½ inches long having an external diameter of 1½ inches and bearing threads to fit the lower tube.



1. Microtome of heavy brass, made and used on a troop transport.

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2. See description in text.

Fitted to the top of the upper tube is a smooth disk or plate, the inner circumference being that of the tube, the outer being 9⅜ inches. The purpose of this plate is to provide a guide for the sectioning razor.

The freezing or expansion chamber (C) is a cylinder having an internal diameter of ¾ inch. It is 1 inch long. Its side wall of 3/16-inch brass is pierced by four ⅛-inch ports for the escape of carbon dioxide (D). The top of this cylinder (E) is 1/16 inch thick and has a roughened exterior surface to prevent slipping of tissues which are placed there for freezing and section. This expansion chamber is mounted inside the upright tube of the lower portion of the microtome and is so projected that its upper surface is ⅜ inch above the upper lip of the tube. It is held in place and supplied with carbon dioxide by a

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¼-inch brass pipe (F) which enters ¾ inch above the base of the microtome. An additional ⅛-inch rod (G) extends from the base to the expansion chamber to insure greater rigidity.

The valve controlling the flow of carbon dioxide should be as near the microtome as possible, so that expansion of carbon dioxide at the valve will contribute to the cooling of the tissue, the final expansion of the gas and cooling effect occurring, of course, in the expansion chamber already described.

In practice the block of tissue to be cut is frozen to the upper surface of the expansion chamber in the usual manner. The upper portion of the microtome is adjusted by screwing it in or out of the lower portion until the tissue just protrudes above the surface of the plate designed to guide the razor. The razor should be held firmly against the plate and passed across the tissue with a rapid, even stroke. Best sections are obtained when the razor is not held flat against the plate but at an angle of 30 to 40 degrees. By screwing the upper portion of the microtome into the lower, following each razor stroke, tissue sections of varied or uniform thickness may be obtained.

A set screw (H) may be mounted on the lower tube so that the upper and lower parts can be locked in any desired position. It is not essential.

A suitable razor may be purchased for about five dollars. This razor is hollow ground on one side and flat on the other. It should be kept carefully honed and stropped. When cutting several blocks, it is well to strop the razor after each block.

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RATPROOFING

That recently constructed tankers are practically immune to rat infestation was amply demonstrated by the experience at New York during the past war. Not one recently constructed tanker vessel of this type required fumigation. The ratproofing of new vessels is supervised by trained sanitary inspectors of the Public Health Service while such craft are under construction. This activity forms a separate chapter of repressive measures at the present time and deserves consideration because of the favorable influence exerted upon sanitary effort.—OLESEN, R., and STONE, J. L.: Increase of rat infestation on oil tankers. Pub. Health Rep. 60: 1296–1301, November 2, 1945.

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COMBINED STRETCHER AND TREATMENT BED FOR TRANSPORTATION OF PELVIC AND SPINAL INJURIES

FRANCIS M. DONEHUE
Captain (MC) U. S. N. R.

The patient for whom this stretcher was designed was a Seabee who had sustained an extensive fracture of the sacrum (fig. 1), due to a 30-foot fall into the hold of a ship at an outlying base. He was brought to the hospital in extreme shock. Immediate surgery was considered contraindicated. Vigorous supportive treatment was given and after 24 hours a greatly distended bladder was relieved by cystostomy. What appeared to be a large hematoma of the right inguinal region was treated by the application of ice bags. He improved steadily over a period of about four weeks, at which time he developed two fistulas, one in the right inguinal region and another in the right buttock, from which mixed urinary and fecal contents exuded.

The patient's condition changed for the worse with the advent of the fistulas; nursing facilities were overtaxed; penicillin was not available; and lastly, exploratory surgery was out of the question, due to the man's grave condition. Evacuation to a stateside hospital via air transportation was deemed advisable.

It was necessary to design a satisfactory stretcher which would keep the patient dry and comfortable en route, and which would allow him to be given periodic care with the minimum of personnel required to accomplish this purpose. Figure 2 shows the result.

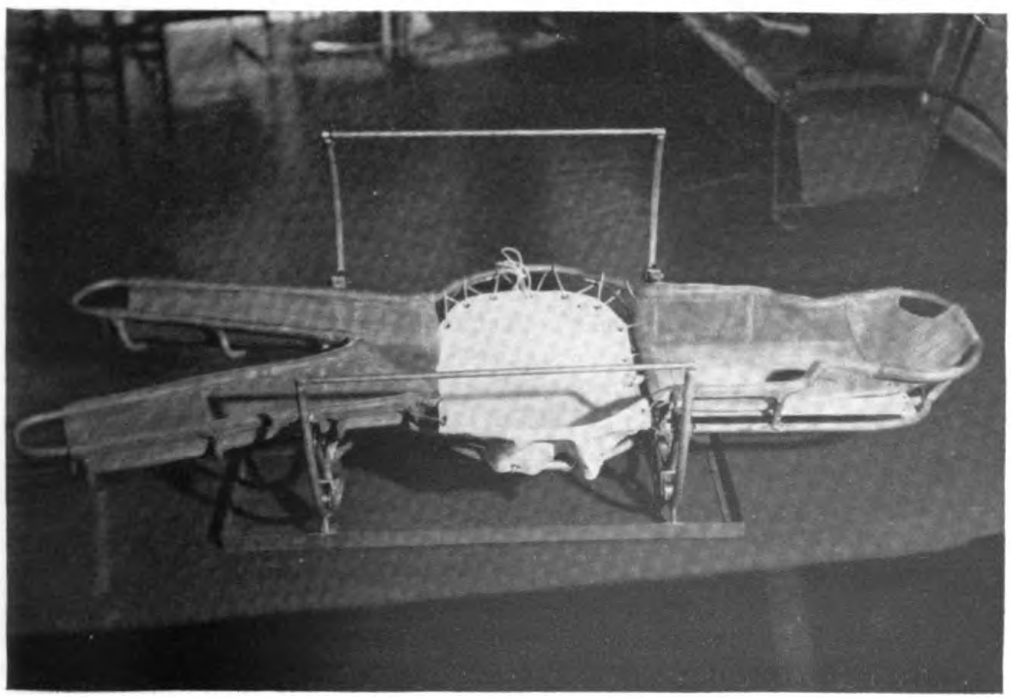
The stretcher allows the patient lying in the supine position to have abduction of both lower extremities, and the mounting on the stretcher unit of four roller bearings extending from the frame, as shown, makes it possible for the patient to be turned sideways for easy cleansing of the area after a bowel movement or redressing, and also provides for return to the supine position after this has been accomplished.

The second unit, which acts as a cradle for the stretcher, consists of two semicircular tracks mounted on a supporting metal base, allowing the axial rotation of the stretcher from horizontal to a position some 15 degrees less than vertical. The injured man, when so rotated, is held undisturbed and in correct position for purposes of inspection, treatment, cleansing or redressing, as above noted, and it is found that with this maneuver, one hospital corpsman or nurse is sufficient to care for the patient's needs, whereas previously five or six corpsmen had been re-

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1. Fracture of sacrum which called for the stretcher improvisation.



2. Combined stretcher and treatment bed.

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quired to lift the patient and change the entire bed several times a day.

Traction and countertraction for lower extremity fractures is available. The stretcher is also rigid enough for hoisting or lowering patients over the side.

The construction of the stretcher and frame is from materials which are available in any ship in the shipfitters' department and in the sail locker. The frame of the modified Stokes stretcher arrangement is constructed from ½-inch pipe. The recess for the patient's upper thorax and head is made of copper mesh screening, as is also the segment which receives the patient's abducted lower extremities.

In the central expanded circular recess which receives the patient's buttocks, one side of the canvas bottom has been secured to the pipe frame, and grommets have been placed along the periphery of the opposite circular frame. This canvas portion can be unlaced for periodic care and tending of wounds as above described. The latticework seen in the upper portion is made of light wood strips, secured by mesh.

The second unit, the rectangular base of angle iron, is welded into one piece supporting the double piped track. It will also be noted that the arrangement provides for the securing of the stretcher to the top rail of the two-track assembly so that after axial rotation the patient's position on his side made be maintained for an adequate period until his cleansing and care have been completed.

CARBON DISULFIDE POISONING

Four monkeys (Macaca mulatta) were chronically poisoned with carbon disulfide by exposing them to inhalation of the vapor for periods of from 12 to 21 months, when marked symptoms of intoxication appeared.

In all of the animals the essential and constant pathologic changes consisted in extensive bilateral and symmetrical necrosis of the globus pallidus and the zona reticulata of the substantia nigra.

The monkeys presented in common profound motor disturbances characterized by reduction and slowness of all types of movement without paralysis, incoordination of locomotion and climbing, plastic cog-wheel rigidity of the skeletal muscles, flexor postural attitudes of the trunk and extremities and severe action and tension tremor.

It is believed that the data justifies the conclusions that the motor syndrome observed in the animals is attributable to the destruction of the globus pallidus and substantia nigra and that there are close similarities pathologically to the Parkinsonian syndrome of man.—RICHTER, R.: Degeneration of basal ganglia in monkeys from chronic carbon disulfide poisoning. J. Neuropath. & Exper. Neurol. 4: 324–353, October 4, 1945.

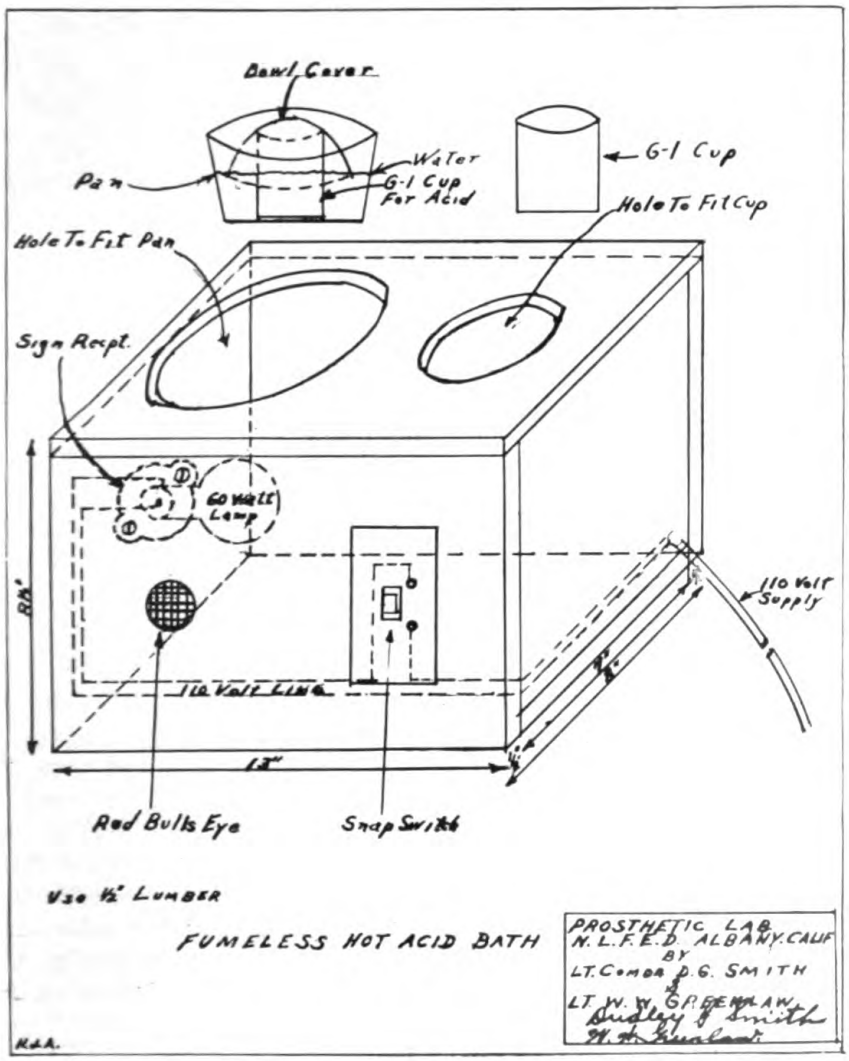
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FUMELESS HOT ACID BATH

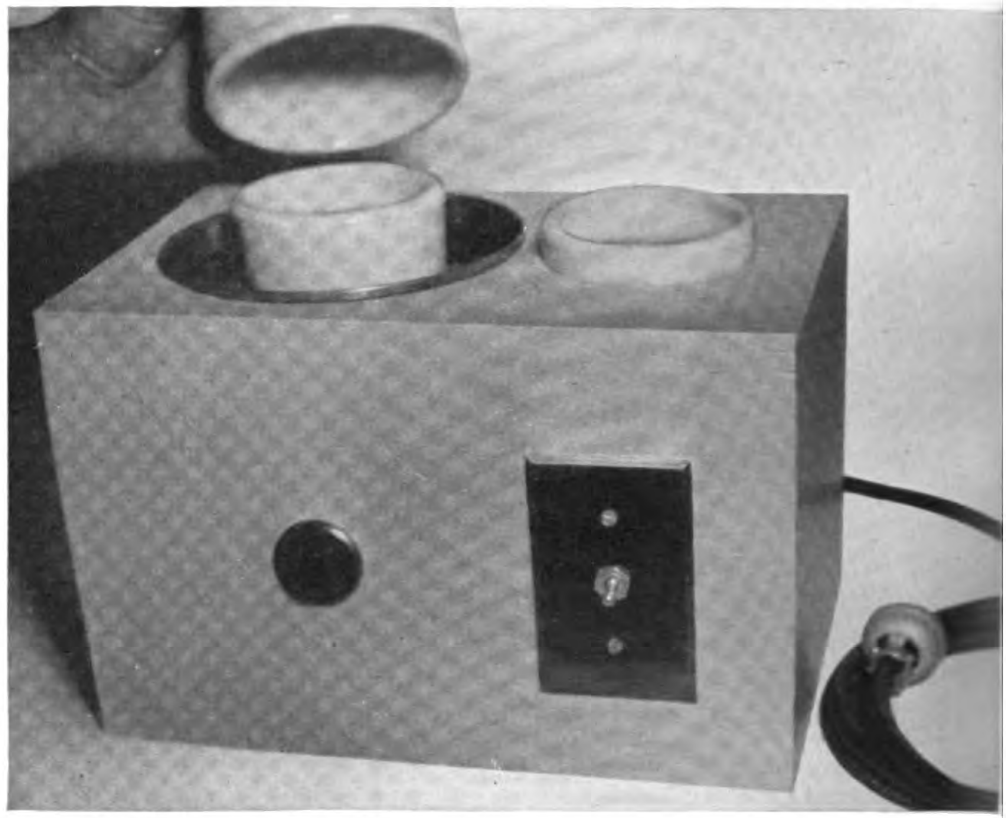
DUDLEY G. SMITH
Lieutenant Commander (DC) U.S.N.R.
and
WALLACE W. GREENLAW
Lieutenant Commander (DC) U. S. N. R.

As a general principle, the pickling of castings and of wrought wire cases is cause for some trepidation on the part of the technician.

The acid bath herein described eliminates the fumes, and pickles more quickly than by boiling, and is much more economical.



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The pan which holds the acid container is filled with water up to and just covering the edge of the inverted bowl.

The 40-watt light globe maintains the proper constant temperature. The procedure is faster, cleaner, and safer. The sodium bicarbonate solution, in the adjoining cup, is always handy for neutralizing the acid.

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SULFANILAMIDE SPRAY FOR DENTAL UNITS

Because sulfanilamide is not a self-sterilizing drug and may be contaminated, an easy and clean method of handling the powder consists in using a glass test tube with a 2-hole stopper through which glass tubing bent at a right angle is passed. Air, when blown through the longer tube, insufflates the powder through the shorter one in a fine spray stream. Placement of the sulfanilamide crystals in alveolar sockets after extraction is easily effected.—ALEXANDER, A. D.: Sulfanilamide spray for dental units. J. Am. Dent. A. 32: 1129–1130, September 1, 1945.

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BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.
(For review)

BONE-GRAFTING IN THE TREATMENT OF FRACTURES, by *J. R. Armstrong, M. D., M. Ch., F. R. C. S., A/W/Comm, R. A. F. M. S. and Surgeon-in-Charge of an R. A. F. Orthopaedic and Fracture Centre; foreword by R. Watson-Jones, B. Sc., M. Ch. Orth., F. R. C. S., Civilian Consultant in Orthopaedic Surgery of the Royal Air Force.* 175 pages; illustrated. The Williams and Wilkins Co., Baltimore, Md., publishers, 1945. Price $7.

This small but complete volume lives up to its title thoroughly. Bone-grafting is taken up as one branch of orthopedic surgery, its principles are discussed, and its technic is clearly described. Controversy is avoided; the author makes it quite clear that he is describing either his own methods or those which he distinctly favors. In no case does he imply that other technics in other hands may be less satisfactory.

The book is extremely well organized and clearly written. There is almost a cookbook's simplicity in the paragraphs devoted to operative technic, which serves to accentuate the careful attention to detail so essential in bone-grafting. General principles are covered in the first five chapters. Here are taken up the general indications for and contraindications to bone-grafting. The importance of careful asepsis and the seriousness of wound infection are stressed. The various types of bone grafts and bone-grafting technics are described but it is evident that the author himself favors the onlay graft wherever its use is feasible. Although inlay, intramedullary and sliding grafts are adequately discussed and the technic well described, the massive onlay graft is prominent throughout the book. It is evident that the author has little use for metal plates. Also favored are autogenous bone pegs rather than metal screws for the fixation of such fragments as the internal malleolus.

The author favors the use of a tourniquet for a bloodless field in

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bone-grafting about the limbs. He maintains that this may be safely left in place up to 2½ hours. This is a longer time than this reviewer thinks safe but no doubt the author speaks from experience. The use of the soft rubber bandage for the lower extremities and the pneumatic cuff for the upper is well advised and gives a minimum of trauma.

Especially worthy of note is the type of screw and the instrument for driving it which is advocated for the fixation of the bone graft. The author explains that in order to avoid pressure atrophy about the screw hole, the hole and screw must be of such size that the screw is retained by the hold of the threads on the bone alone. He avoids the use of the slotted-head screw which necessitates a thrust in its introduction, by using a self-tapping screw with an oblong head. This is screwed home with a special screw driver which the author calls a modified box-spanner and which we in this country would call a socket-wrench. The advantage of this seems obvious and more than compensates for the larger size of screw head which it necessitates.

Chapter V describes adequately the cutting of bone grafts and is well illustrated. The following chapters take up individual fractures and types of fractures and describe in detail their treatment by bone-grafting. In each case the indications are discussed; the preoperative and postoperative care and the steps in the operation itself are fully outlined.

Lest one get a false impression of the frequency of bone-grafting in orthopedic surgery, the book contains an appendix giving some tables of incidence of bone-grafting in the treatment of fractures. This is of definite help in viewing this branch of orthopedics in its proper perspective.

Every orthopedic surgeon and many general surgeons will want a copy of this volume. To the general practitioner, however, it will hardly be of interest.

SURGERY OF THE SPINAL COLUMN, by *Col. Fred H. Albee, M. R. C., U. S. A., M. D., Sc. D., LL.D., F. A. C. S., F. I. C. S., Past President, International College of Surgeons; assisted by Lieut. Col. Harold C. McDowell, M. C., A. U. S., Chief of Orthopedic Surgical Service, Oliver General Hospital, Augusta, Ga.; and Earl J. Powers, M. D.* 460 pages; 229 illustrations. F. A. Davis Company, Philadelphia, Pa., publishers, 1945. Price $8.

This volume covers more territory than its title would lead one to suppose. Following a brief history of spinal surgery and listing of the surgical tools necessary, with emphasis on the Albee-Compere fracture table, the authors proceed in successive chapters to discuss the anatomy of the spine, technic of laminectomy, fractures and fracture-dislocations of the spine, tuberculosis of the spine, static deformities (under which is listed scoliosis), congenital deformities, low back pain, osteomyelitis, spondylitis, tumors of the spine, and finally miscellaneous affections.

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It is obvious that the authors use the title "Surgery of the Spinal Column" in its broadest meaning, as they have included the diagnosis and the conservative and operative treatment of many allied conditions.

Dr. Albee was one of the pioneers in orthopedic surgery. He was an original thinker and a vigorous individualist. This volume is a compilation of much of his work and represents primarily his own methods of treatment. As such, it makes interesting reading, but it fails to present many of the subjects in a well-balanced manner. In some instances it does not discuss satisfactorily the present accepted methods of treatment.

There are numerous slips in proof reading, and although the illustrations are numerous, few of them are original; one (fig. 214) is upside down, and most of them are poorly reproduced.

The postgraduate surgeon, who, studying pathologic conditions of the spine, is searching for the best methods of treatment and for the best operative technics will find much food for thought in this volume. Though much of its content is still the subject of controversy, it does represent the viewpoint of an able orthopedic surgeon.

THE INTERVERTEBRAL DISC: With special Reference to Rupture of the Annulus Fibrosus with Herniation of the Nucleus Pulposus, by *F. Keith Bradford, M. D., Houston, Texas; and R. Glen Spurling, M. D., Louisville, Kentucky.* 192 pages; illustrated. 2d edition. Charles C Thomas, Springfield, Ill., publisher, 1945. Price $4.

Backache and sciatica have presented a clinical problem since the beginning of time. It was not until the role played by the intervertebral disk in the causation of these symptoms was discovered that specific treatment could be given. The second edition of this book brings our knowledge up to date and presents the story of the intervertebral disk and its importance in everyday life.

The pain and disability produced by abnormalities of the intervertebral disk have intrigued neurologists, neurosurgeons, and orthopedists and it has been the close cooperation of these three specialties that has made possible the clarification of the subject.

The protrusion or herniation of the intervertebral disk into the spinal canal can produce variation in sensation and motion as well as a change in reflexes, and this is in addition to the pain. Successful surgical removal of the protruded portion of the intervertebral disk depends upon a careful examination of the patient, including neurologic and roentgen-ray studies.

The authors discuss the embryology, anatomy, and physiology of the intervertebral disk with regard to its reaction to stress and strain, thus explaining the various herniations, protrusions, or ruptures.

The pathologic changes which take place within the disk are described.

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The greater part of the book is taken up by the clinical aspect of the subject, and diagrams, photographs, and drawings are used to illustrate the clinical changes produced in patients suffering from herniated intervertebral disk. Areas of hypesthesia over the legs and feet are of diagnostic importance and are graphically portrayed. The examination with contrast media and roentgenograms is discussed in full.

Other causes of backache and sciatic pain are listed and the differential diagnosis is discussed at some length. The chapter on treatment is particularly well done and stresses the conservative as well as the surgical treatment. The surgical technic has become fairly well standardized and has been improved since the previous edition of the book. A summary of the results of the authors' cases is presented with case reports and compared with the results of others.

While probably orthopedists, neurologists, and neurosurgeons are the only physicians vitally interested in the problem of the intervertebral disk, this book should be available to every practitioner of medicine. The results of surgical treatment in true herniation of the disk are so excellent that no patient should be denied the consideration of his case as a possibility and for that reason this book should be on the shelves of every medical library and should be read by every physician who is called upon to treat backache and sciatica.

COLLECTED PAPERS OF THE MAYO CLINIC AND THE MAYO FOUNDATION, edited by *Richard M. Hewitt, B. A., M. A., M. D.; A. B. Nevling, M. D.; John R. Miner, B. A., Sc. D.; James R. Eckman, A. B.; and M. Katharine Smith, B. A.* Volume XXXVI, 1944. Published August 1945. 858 pages; illustrated. W. B. Saunders Company, Philadelphia, Pa., publishers, 1945. Price $11.

This annual volume contains the usual number of papers published during the past year by members of the Mayo Clinic and Foundation. For the most part, papers are abridged, abstracted or referred to by title. The usual anatomic classification of papers is followed.

Only five of the hundreds of articles may be said to be of a strictly military nature, although medical officers will find much useful information under other headings. These five will be mentioned in some detail.

(1) "Stimulation of wound healing" is a discussion of the effects of powdered blood cells. The cells are dried and a powder produced which is applied to wounds. The effect of the treatment is said to be excellent although not so in "100 percent of the cases." The effect is said to be due to hemoglobin which is compared to chlorophyll in plants.

(2) "Night vision" is an article reviewing the general problem of vision in the dark and contains nothing that is new.

(3) The paper on penicillin and sulfonamide therapy in the management of compound injuries contains a general discussion of the

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subject with no specific reference to the number of cases observed and the exact results obtained. Almost any Naval hospital has probably had much more experience with these types of therapy in compound injuries.

(4) "The effective administration of ether in the tropics" describes a device used in northern Argentina, an area by no means "tropical," in that it lies outside the tropical zone and in a climate quite different from that commonly referred to as "the tropics." The device is, however, simple and should be useful—although ether is certainly not used in military medicine to the extent of other anesthetics.

(5) The discussion on a program of rehabilitation of veterans is timely and reviews the measures now in effect in part or in whole in the United States. There are many quotations from others and the paper ends in a plea to the medical profession to take an active part in the program.

TREATMENT IN GENERAL PRACTICE by *Harry Beckman, M. D., Professor of Pharmacology, Marquette University School of Medicine, Milwaukee, Wisconsin.* 5th edition, reset. 1070 pages; W. B. Saunders Company, Philadelphia, Pa., publishers, 1945. Price $10.

Back in 1930 TREATMENT IN GENERAL PRACTICE first made its appearance. It was a thin unpretentious volume. Casual reading of it, however, made one realize that at last a rather comprehensive popular treatise on treatment had been produced. Today that thin volume has grown fat in the years and become a valued reservoir of practical knowledge on therapy.

This fifth edition includes careful evaluation of the newer developments in medicine. Thirty-two new topics have been included, making it as comprehensive as anything in the one-volume medical literary field.

Naturally the book has grown to a size where it becomes a rather unwieldy and heavy volume, which definitely limits it to the class of reference work. There are those who think one-volume books of this size detract from their usefulness. However Beckman has succeeded in overcoming this drawback by the attractiveness of its printing and its orderly format.

The present volume reflects the parsimony of wartime economy in that the quality of the paper and print appear of an inferior grade to that found in the fourth edition. The bold sideheadings, however, set off the compactness of the printed page and leave a pleasing impression.

Excluding the new additional topics such as acute infectious lymphocytosis, ainhum, atypical or virus pneumonia, cardiogenic shock, crush syndrome, gas gangrene, idiopathic hypoprothrombinemia, Rh factor syndromes, and toxoplasmosis, the general plan and scope of the

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work has not changed from the fourth edition. It is clear, however, to see that the author has endeavored to keep up with the current changes in medical sciences which have been brought about on account of the war. The rapid discoveries in antibiotics and their practical applications have opened up so many new approaches to therapy that the writing of a volume on therapy at this time is a courageous venture. A generous discussion of penicillin therapy, however, is given and its application in various diseases is comprehensive enough.

Any evaluation of a book on treatment in the light of the new chemotherapeutic and antibiotic agents is colored by the trend toward simplification in therapy and the application of medicinals occasioned by recent researches. Emphasis on antibiotics in one sweep has outmoded many of the old reliable forms of therapy. It is refreshing, nevertheless, to have a book of the quality of Beckman's, in order that when the modern methods of therapy fail the old trailblazers may be applied. Anyone presuming to treat patients should have Beckman's work at hand.

A HANDBOOK OF PSYCHIATRY, by *Louis J. Karnosh, B. S., Sc. D., M. C., Associate Clinical Professor of Nervous Diseases, School of Medicine, Western Reserve University, Director of Neuropsychiatry, City Hospital, Cleveland; with the collaboration of Edward M. Zuker, A. B., M. C., Clinical Instructor in Nervous Diseases, Western Reserve School of Medicine; Associate in Neuropsychiatry at Cleveland City Hospital.* 302 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1945. Price $4.50.

This handbook of psychiatry was written for the general practitioner and the student. The authors state that because some of the basic principles on which psychiatry is founded are departures from orthodox medical practice, a handbook presenting the pith of such principles, even though over-simplified, should be valuable for the physician and the medical student. The volume is laid out in the fashion common to psychiatric textbooks, with an historical introduction, a short discussion of heredity and mental disease, and a discussion on the structure of personality and the defense of personality, all leading up to a discussion of the psychoses.

The book is well written. It is free from an overabundance of the jawbreaking vernacular of the various schools of psychiatric thought, and in this reviewer's opinion it does what the authors set out to do. While the discussions of the psychopathology involved are frequently of an analytic nature, the authors are apparently eclectic and utilize the approach of the so-called "American school of psychiatry."

One looks forward to the day when textbooks and handbooks of psychiatry will concern themselves mostly with the psychoneuroses and the psychopathology of everyday life. The physician sees neuroses in abundance, whereas he may go through his entire life without seeing

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a case of Huntington's chorea. This is not a criticism of the present authors, who have done a very good job and have a worth-while book. It is simply a statement of fact, accentuated in the recent conflict. The military forces have found that psychoses constitute only one-tenth of the psychiatric problem.

CLINICAL BIOCHEMISTRY, by *Abraham Cantarow, M. C., Professor of Physiological Chemistry, Jefferson Medical College; formerly Associate Professor of Medicine, Jefferson Medical College; and Max Trumper, Ph. D., Lt. Comdr. H(S) U. S. N. R., Naval Medical Research Institute, National Naval Medical Center, Bethesda, Md.; formerly in charge of the Laboratories of Biochemistry of the Jefferson Medical College and Hospital.* 647 pages; illustrated. W. B. Saunders Company, Philadelphia, Pa., publishers, 1945. Price $6.50.

The aims of this extensively revised edition are "to consider how the internal environment of the body is altered by certain changes in tissue and organ physiology," and "to indicate the manner in which the physician may best avail himself of information which can be obtained by biochemical studies." Physicians and clinicians, in order to take full advantage of the many biochemic tests available to them, must clearly understand the significance and limitations of the results of laboratory investigation. This book is a successful attempt to supply this information in condensed, easily understood form.

The subject of functional diagnosis by the various available laboratory methods is discussed in considerable detail, while the technics of the various methods are usually omitted. The discussion is limited to those phases of biochemistry involved in problems commonly met in clinical medicine. A basic knowledge of biochemistry is assumed, and abstract and theoretic considerations have been excluded.

The first half of the book presents briefly the normal metabolism of carbohydrates, proteins, lipids, etc., and then describes for each metabolite the abnormal metabolism occurring in various pathologic conditions.

The remainder of the book contains chapters on diabetes mellitus, normal and abnormal renal, hepatic, and pancreatic function, cerebrospinal fluid, biochemic changes in pregnancy and lactation, and hormone assay and endocrine function. The final chapter is an outline of chemical abnormalities in various disorders.

The material is well organized and clearly presented; the index is unusually complete. This book should prove useful to most physicians and many biochemists.

NITROUS OXIDE-OXYGEN ANESTHESIA, McKesson-Clement Viewpoint and Technique, by *F. W. Clement, Major M. C. (A. U. S.), formerly Director of Anesthesia at Flower Hospital, The State Hospital for the Insane, Lucas County Hospital, Toledo Dental Dispensary; Anesthetist to Toledo, Mercy and St. Vincent's Hospitals, Toledo, Ohio; Fellow of the International College of Anesthetists.* 2d edition, thoroughly revised. 288 pages; illustrated with 92 engravings. Lea & Febiger, Philadelphia, Pa., publishers, 1945. Price, $4.50.

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Until about a decade ago the progress in the field of anesthesia was comparatively stagnant. Since that time experiments with newly discovered gases, drugs, technics, and armamentarium have emphasized the importance of anesthesia for successful surgery. As a result the mortality rate in all types of surgery has decreased. It was common practice to assign the important duty of anesthesia to a registered nurse, but in recent years the specialist in anesthesia has become recognized as a necessity.

Except for the induction stage, nitrous oxide is seldom used as a general anesthetic. It is believed that this is due to the meager knowledge of the anesthetist about this gas. This book gives a thorough and concise discussion which will encourage the use of this gas, because its advantages surpass some of those of the more commonly used gases or combinations. Although the subject is about a specialty within a specialty, the book has very concise and important general information for the student of anesthesia. There is an excellent chart on the signs of the stages in anesthesia with an adequate discussion, omitting much detail or reference.

The chapters are unique in that each one is summarized for quick reference. The subject matter is covered completely and very clearly. The illustrations and organization are excellent, and each chapter discusses important questions and phases of anesthesia. The chapters on "Charting and Shock," "Classification of Patients," and "Special Operations" are especially interesting and informative for the surgeon as well as the anesthetist and are not found elsewhere. The interpretations of blood pressure are presented briefly but impressively; this important phase is rarely mentioned in other reading matter on the subject.

In the reviewer's opinion this book is valuable to the student as a text, and an asset to the specialist in anesthesia. To the medical officer in the United States Navy its value is limited, because spinal and intravenous methods are used in the majority of operative procedures.

VIRUS AS ORGANISM, Evolutionary and Ecological Aspects of Some Human Virus Diseases, by *Frank MacFarlane Burnet, M. D., F. R. S., Director, Walter and Eliza Hall Institute of Research in Pathology and Medicine, Melbourne, Australia.* 134 pages. Harvard University Press, Cambridge, Mass., publishers. 1945. Price $2.

This book is the most recent in the series of Harvard University Monographs in Medicine and Public Health and represents an expansion of the Edward K. Dunham Lectures for the Promotion of the Medical Sciences for 1944. The world-wide recognition of Doctor Burnet as an authority in virology would predicate an outstanding essay; the present volume justifies the prediction.

The thesis is developed that "viruses are micro-organisms that have

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evolved by parasitic degeneration from larger micro-organisms, many of them in all probability from bacteria." The logic is followed that in the past all, or nearly all, the known virus diseases of man must have evolved from lower animal infections by a variational process favorable to the selective survival of suitable mutants. In developing the argument there are discussions of certain characteristics of the viruses associated with herpes, poliomyelitis, smallpox, yellow fever and influenza. The various chapters should be as interesting reading to the expert as they are to the novice.

A refreshing style of writing is employed; the absence of errors is noteworthy. Pertinent references add to the value of the book. In summary the reviewer found the contents to be stimulating, both in thought and in suggesting lines of investigation in a very important scientific field.

HUMAN ANATOMY AND PHYSIOLOGY, by *Nellie D. Millard, R. N., M. A., Instructor in Anatomy and Physiology, School of Nursing, Michael Reese Hospital, Chicago, Illinois; Graduate of Wesley Memorial Hospital School of Nursing, Chicago; and Barry G. King, Ph. D., Lieutenant U. S. N. R., Naval Medical Research Institute, National Naval Medical Center, Bethesda, Maryland; formerly Assistant Professor of Physiology, College of Physicians and Surgeons, Columbia University, New York.* 514 pages; 297 illustrations (43 in color), 190 by Lucille Cassell. 2d edition, reset. W. B. Saunders Company, Philadelphia, Pa., publishers, 1945. Price $3.

This book is a handy-sized volume with questionable value as a text-book for hospital corpsmen. The style is direct but decidedly unstimulating. The approach to the material was said to be "functional," but we found little to substantiate this claim. Simple comparisons to life in general are neglected, as are practical applications to nursing.

The summaries at the close of the chapters are not always as clear and specific as they could be and the questions are poorly put and lack challenge.

As a reference book the material on each subject is too limited to be of great value. For the interested corpsman, lengthier discussions of each subject would be more desirable.

SURGICAL NURSING, by *Eldridge L. Eliason, A. B., M. D., Sc. D., F. A. C. S., John Rhea Barton Professor of Surgery, University of Pennsylvania Medical School; L. Kraeer Ferguson, A. B., M. D., F. A. C. S., Captain (MC) USNR, Assistant Professor of Surgery, University of Pennsylvania Medical School; and Evelyn M. Farrand, R. N., B. S., Formerly Instructor in Nursing Arts and Surgical Nursing, University of Pennsylvania School of Nursing.* 7th edition. 585 pages; 259 illustrations with 7 subjects in full color. J. B. Lippincott Co., Philadelphia, Pa., publishers. Price $3.25.

Frequently a book is encountered which has a specific need and use. Such is this compact volume which contains so much practical information about surgical nursing. At first glance the volume seems

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valuable only to the nursing staff but upon closer examination, the text, illustrations, and discussion of anatomy, physiology, and surgical therapy, as well as nursing care, make it valuable to the surgical staff of every hospital. In fact every physician who has a surgical service will realize the importance of this book as a teaching aid.

The pre- and post-operative care of surgical patients has become increasingly important and is so involved with the nursing care that it is difficult to find a textbook or article which covers the subject.

The authors of this book, in revising it for the seventh edition, have made every effort to present systematically the problems encountered. Illustrations of the different bandages, instruments, utensils, autoclaves, sterilizers, needles, and sutures, as well as methods of examination, make the book valuable to interns and graduate students of medicine as a reference work. The Wangensteen apparatus and tidal drainage equipment is illustrated and explained, as well as are orthopedic and neurosurgical appliances.

At the end of each chapter there are references and suggested readings, with an outline for conference material.

This new edition has been so carefully compiled that it should be available to every intern, resident, and graduate student of surgery, as well as the surgical nurse.

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PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge

TSUTSUGAMUSHI DISEASE

EPIDEMIOLOGY AND METHODS OF SURVEY AND CONTROL[1]

DAVID H. JOHNSON
Lieutenant H(S) U. S. N. R.
and
GEORGE W. WHARTON
Lieutenant H(S) U. S. N. R.

Tsutsugamushi fever is an endemic rickettsial disease in rural and sparsely inhabited parts of eastern Asia, northern Australia, and the larger island groups of the western Pacific and eastern Indian oceans. At various places the disease has also been called scrub typhus, Mossman fever, rural typhus, tropical typhus, Japanese river fever, kedani fever, flood fever, and pseudotyphus. The virus is transmitted by chiggers, which are the parasitic larvae of certain species of mites. The normal hosts of the vectors are rodents and other land vertebrates, some of which are known to become infected with the disease. Man is not a normal host for the chiggers, and it is unlikely that transmission of the disease from man to man or from man to wild animals takes place. It is also unlikely that tsutsugamushi disease has been spread to new areas within recent times by human agency.

The suggestion is frequently made that some of the wartime outbreaks resulted from introduction of the disease by Japanese troops, but there is no evidence that this occurred. The fact that natives appear to be immune to the disease in places where white troops contract it, may indicate that the natives have been exposed for a long time to the infection; this aspect of the problem has not been sufficiently studied. In the past, white men in scrub typhus areas were mainly missionaries, traders, and plantation owners whose ordinary activities did not expose them to chigger bites. In contrast to this situation, large numbers of white troops were actively engaged in work,

[1] U. S. Naval Medical Research Unit No. 2.

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such as cutting brush and building roads and trails, where they were constantly exposed to chigger bites.

The recognition of endemic centers of tsutsugamushi fever is necessary for proper control. Methods of control are directed at preventing infected chiggers from biting men; this is accomplished by (1) avoidance of infective areas, (2) use of miticides on the skin and clothing, (3) destruction of chiggers and their normal hosts, and (4) elimination of habitats suitable for chiggers and their hosts. A program for control must include measures designed to reduce the hazard in the shortest possible time and others designed to prevent recurrence of the danger.

EPIDEMIOLOGY

GENERAL

Some knowledge of the ecology of vectors and their normal hosts is required in order to understand and appreciate the pertinent aspects of the epidemiology of tsutsugamushi fever. A focus of infection may be circumscribed within a radius of a few hundred yards, or it may extend over many square miles. The extent of an infective area is largely determined by the habits of the vector and its hosts in relation to their environment. As surveys multiply, more knowledge will accumulate which will make recognition of infective areas a simpler matter.

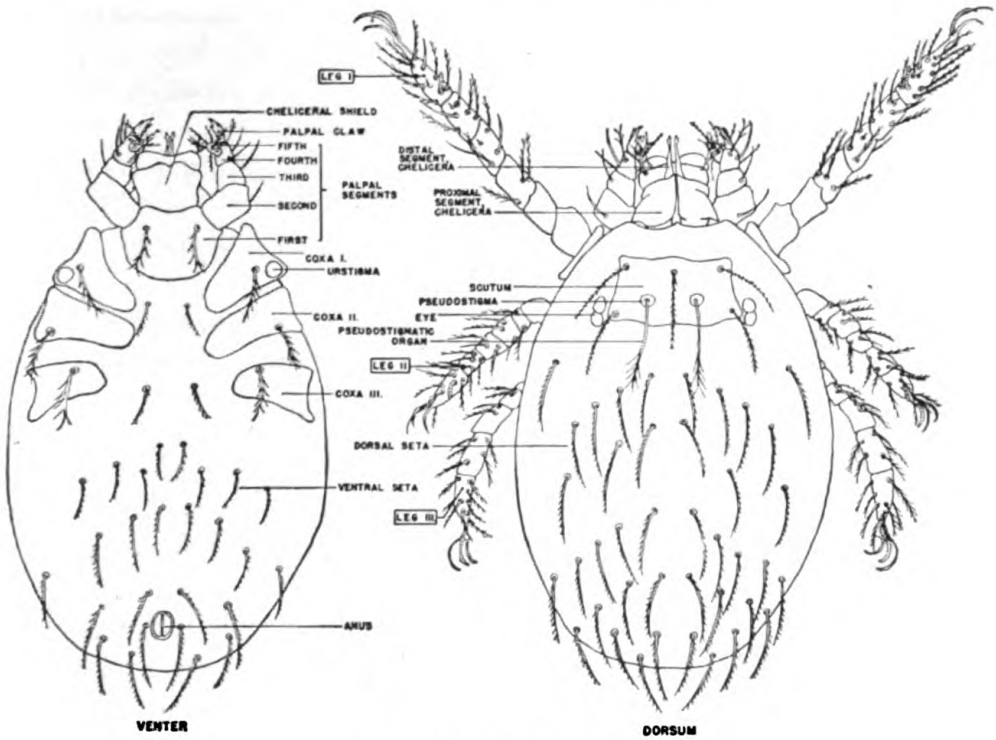
CHIGGERS

Recognition of chiggers.—Chiggers are the larvae of mites of the family trombiculidae (fig. 1). More than a hundred species of chiggers have been described from the area in which scrub typhus is endemic. The total number of species present is conservatively estimated to be about one hundred fifty. Furthermore the species of trombiculidae represent only a small fraction of the mite population. They are small, about 0.3 mm. long, roughly egg-shaped, and bright red to cream in color. These characteristics can be observed with the naked eye. Many small insects, adult mites, and larval mites other than chiggers are readily mistaken for trombiculid larvae, unless microscopic examination is made. Other larval mites, especially those belonging to the families trombidiidae and erythraeidae, are easily confused with chiggers, even when examined microscopically. True chiggers have the following characteristics in common; any larval mite that does not possess all of them is not a chigger:

1. A five-jointed palp, the distal segment of which opposes, in thumb-like fashion, an immovable claw on the penultimate segment. The setae on the palp are arranged as follows: One each on segments 1, 2, and 3; three on segment 4; and as many as seven on segment 5.

2. A pair of chelicerae made up of two segments. The proximal segment is muscular while the terminal segment consists of a chitinous

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Trombicula akamushi

needle that may be variously armed by projections called teeth.

3. A single dorsal plate or scutum situated anteriorly. The scutum is usually provided with five setae; some genera have only four, while others may have as many as twenty. The scutum always bears a single pair of pits called pseudostigmata, from each of which extends a specialized seta known as a pseudostigmatic organ. The pseudostigmatic organ may be of various shapes from filiform to globose. Some larval mites have more than a single scutum or more than one pair of pseudostigmata; these are not chiggers.

4. Dorsal setae arranged symmetrically in transverse rows posterior to the scutum.

5. A striated leathery cuticle over the body except in thickened areas such as the scutum and appendages.

6. Three pairs of jointed legs, each with three fine claws on the terminal segment.

7. A pit at the posterior distal angle of the first segment, or coxa, of the first pair of legs. These pits are known as urstigmen.

8. Ventral setae usually situated as follows: A median pair between the first pair of coxae and another pair between the third pair of coxae; several transverse rows posterior to the legs extending to the posterior margin of the body.

Ecology.—Chiggers parasitize all groups of land vertebrates: Amphibians, reptiles, birds, and mammals. Once a chigger is on a host,

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it selects an area where the skin is soft and inserts its chelicerae. It then injects into the wound saliva that dissolves the host tissues in such a way that they are available as food. It is thought that the rickettsiae of scrub typhus are injected with the saliva. The chigger remains attached at the original site of attack until it becomes replete. It then detaches itself, falls to the ground, and buries itself in the upper layer of the soil, where it passes into a quiescent state. During the quiescent period it transforms into a nymph.

The nymph differs in form from the chigger; it is usually hourglass-shaped, has four instead of three pairs of legs, and is densely clothed with setae. However it resembles the chigger in color. After a period of feeding, the nymph transforms into the adult, which closely resembles the nymph. The adults are male or female. Both the nymphs and the adults are nonparasitic, soil-dwelling organisms. They are sensitive to extreme dryness or wetness. On the other hand, they must have moist, well-drained soil in which to live. Their food habits are largely unknown, but the available evidence indicates that they feed on decomposing organic matter in the soil, or on bacteria and fungi in the organic matter. Eggs have never been observed except in gravid females. They are probably laid in the soil.

Upon hatching, the larvae or chiggers lurk beneath the litter where they are in a position to attach themselves to a host. During dry spells, unattached chiggers remain beneath the litter and do not attack man unless the litter is disturbed; in especially moist seasons they are active at the surface and are very likely to attack man. When any object disturbs the litter, they immediately swarm over it. It is this habit that explains the lack of host specificity. When there is apparent specificity, it results from the fact that the eggs are laid in environments inhabited regularly by a few host species. For example, Trombicula deliensis, which carries tsutsugamushi disease, is found in some areas only in the burrows and covered runways of rats. Men become infected only when they contact these micro-habitats.

The larvae, nymphs, and adults of the family trombiculidae probably do not travel more than a few yards in the soil. Dissemination is accomplished in the larval stage as a result of the movements of hosts to which the chiggers are attached. Men engaged in clearing operations and those who first enter an infected area are the ones who usually contract the disease, because the habitats of the mites are invaded and disrupted, and the men are exposed to their bites. As a result of the clearing, the mites and their habitats are destroyed and the subsequent incidence of infection is reduced. The chigger is the only parasitic stage in the life cycle of the mite, and, furthermore, it bites only once; therefore it is assumed that the rickettsiae must be passed from one generation to the next through the egg.

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HOSTS

Definition of host.—The term "host" is used here in a restricted sense for any species of animal that is parasitized by chiggers. At least some of these animals become infected with the virus of tsutsugamushi disease and have been commonly written and spoken of as "reservoir hosts." Since the infection is supposed to be transmitted directly by way of the egg through successive generations of mites, and since infection of chiggers from their hosts has not been demonstrated so far as is known, it remains an open question whether the vertebrate hosts or the chiggers themselves constitute the real "reservoir" of the virus. In either case the presence of a suitable host is necessary for maintenance of the mite population and at least indirectly for maintenance of the virus.

Kinds of hosts.—Chiggers attach themselves to a wide variety of vertebrate animals. Small terrestrial rodents and other ground-dwelling mammals are regularly parasitized by the chiggers that carry the rickettsiae of tsutsugamushi disease. Rats (rattus and related genera) are usually the most numerous hosts of the vectors of the disease. At least one and frequently as many as four or five species of rats occur at each site where the disease has broken out. Since tsutsugamushi disease is chiefly of rural occurrence, the native wild rats of an area are more frequently involved in its transmission than are the well-known house rats of cities and towns (Rattus rattus and R. norvegicus).

Whereas the city rats usually belong to the two species mentioned and are similar in most parts of the world, the wild native rats belong to species of relatively restricted distribution. Therefore the wild rat population is likely to be composed of different species at different places. Except for the house rats, no one species is distributed over the entire area in which tsutsugamushi disease occurs. The vole Microtus montebelloi, which is associated with the disease in Japan, does not occur in tropical regions.

Birds of certain species that nest and forage on the ground are also attacked by typhus-bearing chiggers, and they probably play an important part in spreading the disease from place to place during their annual migrations. Snakes, lizards, turtles, and frogs are parasitized by certain species of chiggers, but not regularly by those that carry scrub typhus.

Habits of rats.—Most kinds of rats forage on the ground where they are exposed to attacks by chiggers. Some species build nests at or below the level of the ground. Species with burrowing habits usually live where the soil is firmly packed and moist but not wet, and where there is low vegetation. Such a situation is also ideal for the free-living stages of the mites and for unattached chiggers. Some of the

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smaller rats build nests in hollow coconut shells lying on the ground.

Burrows usually enter the ground in such protected places as between roots at the bases of trees, beneath logs or rocks, and in crevices of coral outcroppings or fissured cliffs. Certain arboreal species of rats build nests in hollow trunks of trees and in stumps. Runways used in foraging or moving from place to place tend to follow naturally protected routes, running on the ground through dense vegetation, beneath logs, and along rock ledges.

CHARACTERISTICS OF SITES WHERE SCRUB TYPHUS OCCURS

Sites in which scrub typhus has been contracted are characterized in common by moist but porous and well drained soil and by the low-growing green herbaceous and shrubby vegetation. These conditions prevail at the borders of the grassy openings in jungle areas, on the flood plains and lower terraces of river banks, at the edges of the jungle adjacent to sandy beaches, and in the vicinity of partly weathered outcroppings on raised coral islands. Unfortunately these are the places that offer the most attractive sites for camps and bivouac areas. Abandoned plantations and old village sites have been important foci of the disease. The coconut, papaya and other food plants and trees provide a source of food for rats. Second-growth scrub that invades clearings converts them into ideal habitats for the free living stages of trombicula. Conditions favorable for scrub typhus are apparently lacking in muddy or dry soil, in open sandy or gravelly areas, and in heavily shaded ground beneath jungle trees.

SURVEY

HOSTS

Collection of rodents.—Rats and other mammals of similar size can be caught in standard rat traps. The most satisfactory bait is a small cube of fresh coconut or fresh raw meat, securely attached to the trigger of the trap. Fresh apple, fruit, such as raisins or prunes, and peanut butter also may be used. Traps should be set late in the afternoon and inspected early the next morning. If continued trapping is carried on, the bait should be renewed regularly. For a thorough survey of the rat population of an area, traps should be set in large numbers and be kept in operation for several nights. Two or three men can easily set and tend a hundred or more traps. If fewer traps are set, rare species may be overlooked and the data gathered on relative rat populations and frequency of parasitic infestation will be less reliable.

Traps may be set in a line at regular intervals, preferably 15 to 25 paces apart. Care should be used to sample all sorts of habitats, such as open places, clumps of grass, patches of shrubs, forest, jungles, rock ledges, cliffs, banks of streams, and edges of swamps. For arboreal species traps may be nailed or wired to the trunks of trees or

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on horizontal branches. For intensive study of a small area traps may be set in quadrant fashion, regularly spaced at the rate of 16 or more traps per acre. If the different habitats to be sampled are clearly defined and extensive enough, this method will give good quantitative data on habitat preferences of different species of rodents. Much time will be saved in following a trap line if the site of each trap is marked by tying a piece of cloth or twisting some white cotton on a nearby twig at eye-level height.

Other hosts.—A variety of vertebrate animals other than rodents may be found in the area being surveyed. Monkeys, shrews, bandicoots, birds, snakes, lizards, turtles, and frogs may be exposed to the bites of tsutsugamushi disease-bearing chiggers. Some may play a regular part in supporting the mite population. A complete faunal survey of an area is a large and time-consuming undertaking, but no opportunity to examine potential hosts of typhus-transmitting chiggers should be overlooked. Most kinds of birds and small diurnal mammals may be obtained by using a shotgun.

Handling infected animals.—When rats are taken from the traps they should be segregated according to species and placed in containers from which chiggers cannot escape. Paper bags tightly folded at the top, or metal cans with tightly fitting lids, are satisfactory. Perhaps the best method, if sufficient alcohol can be obtained, is to carry a small tank of 80-percent ethyl alcohol and to immerse the rats in this as soon as they are taken from the traps. The attached chiggers will be killed in situ and the risk of infection from handling will be reduced. Persons engaged in making field surveys, especially when examining suspected hosts and vectors, must wear impregnated clothing and apply dimethyl phthalate to the hands and wrists frequently.

Examining hosts.—Hosts suspected of being parasitized by chiggers should be brought into the laboratory in chigger-proof containers or in alcohol. Those in chigger-proof containers must be handled with care so that no ectoparasite escapes, and, to protect the examiner, his hands and arms should be smeared liberally and frequently with dimethyl phthalate. The mite-proof container should then be placed on a tray to which dimethyl phthalate has been liberally applied. The container is then opened and the specimens are removed.

Care must be exercised so that the container or specimens removed from it do not extend beyond the dimethyl phthalate-treated tray. The container should then be examined carefully. All mites or other ectoparasites found should be placed immediately in 80-percent alcohol. If the container is expendable, it should then be burned; otherwise it should be thoroughly smeared with dimethyl phthalate and stored until needed again. The entire surface of the skin of each host should be examined. Colonies of chiggers will appear as reddish patches, single chiggers will be seen as small red dots.

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On mammals the chiggers will be found most frequently on and in the ears, about the groins, axillae, and mammae. The hair must be turned back so that the skin is visible. Birds are most frequently parasitized on the legs, under the mandibles, and about the ears and eyes. The skin between the feather tracts must be examined also.

Chiggers attach themselves to reptiles between and under the scales. When found the chiggers are most easily collected with a dissecting needle that has been flattened at the tip to resemble a cataract knife. They are removed from the host by a scraping motion; the needle should be pressed firmly against the skin of the host and drawn toward the infested area. This action will remove most of the chiggers unharmed. After removal, they should be placed in 80-percent alcohol.

Collecting unattached chiggers.—The materials required for the collection of unattached chiggers are: Objects with shiny black or white surfaces, a camel's-hair brush or sharpened stick, and a vial of 80-percent alcohol. Oilcloth, porcelain ware such as cups or bowls, china ware, or the collector's shoes are adequate. The color is important: Black or white offer sufficient contrast; browns, reds or yellows do not. The sharpened stick mentioned is for picking chiggers from the shiny surfaces; however a small camel's-hair brush is to be preferred. The stick or brush must come to a fine point not over 0.2 mm. in diameter, so that the chiggers collected will not be lost. Such a fine point enables the collector to see the specimen at all times. The vials should be small, such as empty procaine tubes which are available from any dentist.

White porcelain cups are especially satisfactory collecting surfaces; if they are not available other surfaces can be substituted. Place the cup on the ground so that as large an area as possible is contiguous to the litter. Leave it undisturbed for from 1 to 5 minutes depending on the abundance of the chigger population. Pick it up and carefully examine all surfaces both inside and out. If chiggers are seen, they will appear as rapidly moving red dots about 0.3 mm. in diameter.

Wet the brush with the lips or with alcohol, adjust it to a fine point, catch the chigger on it, dip the brush in the vial of alcohol, and be sure that the specimen is washed off before attempting to collect another chigger. If a single cup is used, the chiggers are best picked off as they appear. Only the chiggers in the immediate vicinity of the cup will be caught.

Places inhabited by the normal hosts of the chiggers will be most productive. Runways, resting spots, or nests, if they occur in well-drained moist soil, should be sought. Extremely local distribution is not unusual. At one place chiggers were so localized that none could be collected from the floor of a rat burrow while as many as 25 a minute were found on the ceiling. In another instance numerous chiggers

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were collected from a sunny spot in the jungle, while 10 yards away in the deep shade none could be found.

Microscopic examination is necessary in order to determine whether or not the specimen collected is actually a chigger. Satisfactory temporary mounts can be prepared as follows: Place a drop of 95-percent phenol on a clean glass slide, transfer the specimen directly from the 80-percent ethyl alcohol to the drop of phenol, and put on a cover glass.

Men engaged in collecting unattached chiggers are exposing themselves to the most dangerous areas as far as tsutsugamushi disease is concerned. They should wear impregnated clothing and apply liquid dimethyl phthalate to all areas of exposed skin.

Procedure.—The most efficient collectors of chiggers are their normal hosts. In surveying an area, hosts should be examined first, and if chiggers are found on them, a survey must then be made for unattached chiggers. If the area is small, all habitats should be tested. Samples from ten cups allowed to remain 5 minutes in each microhabitat should be sufficient. In large areas complete surveys would be too time-consuming. However, each type of habitat should be tested. Before occupation by troops, the areas to be tested can be selected on the basis of the distribution of the chigger's hosts as indicated by the trapping records. After occupation, reports of troops bothered by chigger bites or infected with scrub typhus can also be used as a guide.

INTERPRETATION

Within the geographic range of scrub typhus, if chiggers are found on small mammals, scrub typhus should be suspected of being endemic in the area. When such a condition exists, control measures should be taken immediately. The actual presence or absence of the disease will be determined by the course of events. In the absence of any cases of scrub typhus in such an area expert opinion should be obtained before control measures are relaxed. If chiggers are not present on small mammals, scrub typhus probably is not endemic in the area. An abundant chigger population on birds or reptiles usually indicates that pest chiggers will annoy the troops. The evidence available indicates that pest chiggers do not carry scrub typhus.

The localized areas from which most of the cases of scrub typhus come will be those where there are many unattached chiggers whose normal hosts are mammals. When chiggers are present only on the mammals, the most highly infective areas will be those in which the largest numbers of unattached chiggers are found, but when the pest chiggers of birds and reptiles are also present, points of maximum concentration of unattached chiggers may or may not be dangerous.

If several species of mammals and chiggers are present it is necessary to identify each species and to record its distribution and habits. Only

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two species of chiggers are known to carry tsutsugamushi fever; they are Trombicula deliensis and Trombicula akamushi. Trombicula walchi, which is thought to be the vector in New Guinea, is probably only a local variant of Trombicula deliensis. However, other species may be found to be vectors, and it is possible that uninfected, and thus harmless, populations of Trombicula deliensis and Trombicula akamushi exist. In the absence of specialists, specimens should be sent to the Naval Medical School for identification.

CONTROL

MITICIDES

Sulfur.—Sulfur powder has been used for many years as a miticide and mite repellent. Its use on troops gives some protection, but it is inferior to the newer miticides. In tests, sulfur powder was effective as an area decontaminant against chiggers in Georgia when applied at the rate of about 100 pounds per acre.

DDT.—Because of its slow action, DDT should be used against chiggers only as an area decontaminant. Five to ten pounds per acre of a 10-percent dust are required. The 10-percent dust issued in 2-ounce sifter top cans by the Army and Navy as a louse powder is ineffective when used for personal protection against chiggers. At least one outbreak of scrub typhus was not quickly brought under control because DDT applied in this manner was used in preference to dimethyl phthalate.

Dimethyl phthalate.—The most effective miticide available in large quantities in the Pacific area was dimethyl phthalate. It is listed in the Supply Catalog under stock number S13–449 in 1-gallon containers labeled Insect Repellent, Liquid; the Army carries it under QM Stock No. 51–R–300. Insect Repellent, Liquid is also available in 2-ounce bottles under stock number S13–450. These 2-ounce bottles may contain one of four liquids: (1) Dimethyl phthalate; (2) indalone, (3) Rutgers 612; or (4) a 6:2:2 mixture of the three.

Dimethyl phthalate can be recognized by its lack of color, and slight, if any, odor. Dimethyl phthalate from the large containers is used in the following procedures:

1. As a decontaminating spray for use on floors and under tents and buildings in heavily infested areas. It is recommended for use in this manner especially for places in the camp where dead rats have been in traps overnight. It can be distributed satisfactorily by means of a knapsack sprayer.

2. As a spray for impregnating clothing. It should be applied to the clothing as a wet spray so that complete coverage is obtained. Any portion of the clothing not covered will be a place capable of harboring chiggers. Two to four ounces of dimethyl phthalate should

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be used per uniform. Untreated shorts should be worn under the uniform to avoid irritation of the skin.

3. As the active ingredient of a miticidal emulsion for the impregnation of uniforms and blankets. Mass impregnation can be accomplished by laundries and Chemical Warfare processing companies. The instructions for manual impregnation give enough information for adapting the process to laundry machinery. When laundry facilities are used, the impregnation process must *not* be incorporated as just a final rinse; only clean, *dry* clothing should be put in the impregnating bath.

A. Materials required to treat 100 uniforms with the soap emulsion method:

Dimethyl phthalate	quarts	7.5
Navy or G. I. laundry soap (approx. 7 cakes)	pounds	6
Water	gallons	35
55-gallon oil drum		3
35-gallon G. I. or similar container		1
G. I. egg whip (wire)		1

The above materials are used to make 37 gallons of an emulsion containing 5-percent dimethyl phthalate and 2-percent soap; it is prepared and used in the following manner:

B. Procedure:

1. Cut soap into small pieces and dissolve in 10 gallons of boiling water. Heat is required only to hasten the solution of soap. When soap is completely dissolved, pour it into 25 gallons of cold water contained in a 55-gallon drum.

2. Pour 4 or 5 gallons of this soap solution (1) into a G. I. can or similar container, add 7.5 quarts of dimethyl phthalate slowly while whipping vigorously with an egg whip to make a creamy concentrate.

3. Pour this concentrate (2) into the drum of soap solution (1) and stir to make the finished emulsion.

4. To preserve the emulsion, stir it slowly while clothing is being dipped.

5. Put socks and caps in pockets. Immerse clothing, including parts held in hands, and wring out over a second container to save excess liquid wrung from the clothes. Hang uniform out to dry.

C. NOTE.—To assure adequate treatment and to avoid dilution of the emulsion, only dry uniforms should be dipped. When men dip their uniforms by muster, at least two drums over which the clothes are wrung should be used to each container employed for dipping, since it takes twice the time to wring that it does to dip. The solution that is wrung out of the dipped clothing should be poured back into the dipping tank as soon as sufficient liquid has collected. With one dipping can and two wringing cans, 100 uniforms can be impregnated in an hour.

D. Treatment of blankets: Since a blanket absorbs about three times as much emulsion as does a uniform, the quantities mentioned for 100

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uniforms should be tripled for treating 100 blankets. Blankets are treated in the same manner as described for uniforms.

E. Remarks: After the clothing is thoroughly dry, it can withstand wetting; however during the drying process it should be protected from rain. A delay in the drying of 1 or 2 days under cover will not affect miticidal properties. Untreated shorts should be worn under treated uniforms to avoid irritation of the genitalia. Skin reactions of a nature serious enough to contraindicate the use of impregnated clothing have not been reported. Unless subjected to frequent and heavy rains or immersed in water, uniforms will remain effective during wear for 2 weeks. When dry, they will remain effective in storage as long as 2 months. Blankets should be re-treated every 3 months. If treated blankets and uniforms are laundered, the miticidal properties disappear. Reimpregnation must follow each washing.

The 2-ounce bottles of dimethyl phthalate can be used as follows:

(1) Smear method: Shake about one-fourth of a teaspoonful of liquid into the palm of one hand, rub both hands together, and then rub them lightly over the socks and uniform. Repeat this procedure until all the clothing has been treated; usually a 2-ounce bottle will be sufficient for a uniform. An even application can be made with this method if the hands are rubbed lightly over the cloth; however if the rubbing is too vigorous, uneven distribution results. A uniform properly treated in this fashion will retain its miticidal properties on exposure to water much better than will uniforms impregnated with the emulsion.

(2) Barrier method: Draw the mouth of the bottle along the cloth to apply a thin layer of dimethyl phthalate one-half inch wide around or along all openings of the uniform: Neck, fly, and cuffs of shirt; waist, fly, and cuffs of pants; socks above shoes; and all parts of leggings. One ounce of fluid should be used per treatment. The barrier method provides protection while the clothing is worn. When the clothing is removed it should be placed in boiling water so that any mites on it that have not come in contact with the dimethyl phthalate will be killed and not carried into the quarters.

(3) Protection of exposed skin: Dimethyl phthalate should be smeared lightly over all exposed skin. Care should be taken to avoid the eyes and lips, as it will cause a burning sensation.

Dibutyl phthalate.—Dibutyl phthalate is used in preference to dimethyl phthalate by the Australian Army. It may be used in place of dimethyl phthalate in any one of the methods described. Its effect on the mites is slower than that of dimethyl phthalate, but its effectiveness is said to endure longer. The Australian Army uses the smear method of clothing impregnation in preference to the dipping method. They have had considerable success with it and assure fairly proper treatment of uniforms by means of standardized drill.

AREA CONTROL

Introduction.—When it has been decided to establish a camp in an area where danger from scrub typhus is suspected, operations should be directed at destroying the existing populations of rats and chig-

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gers and eliminating the habitats favorable for reinvasion of the area. At most military bases, it is possible to obtain the advice and assistance of officers who are trained and equipped for controlling rodents and epidemic diseases.

Rat control.—Rats should be exterminated by large-scale and persistent trapping operations. The dead rats should be taken from the traps and burned. Trapping, though more troublesome than poisoning, is recommended about camp areas where tsutsugamushi fever is present, because poisoned rats usually die in inaccessible places and their chiggers may escape to continue their life cycle or to seek another host. Rat populations in uncleared areas surrounding a camp can be kept at a low level by poisoning in order to prevent individual rats from wandering into the camp.

Clearing and burning.—In areas shown by preliminary surveys to be infested with chiggers, the vegetation should be cut and removed and the remaining stubble should be burned. In humid tropical areas, attempts to burn the damp vegetation before cutting have proved unsuccessful, because the chiggers are in the litter covering the surface and in the upper layers of the soil, where they are not harmed by superficial burning of the vegetation. Stubble should be sprayed with Diesel oil or kerosene before attempts are made to burn it. At some places, tank trucks equipped with pumps, hoses, and flame-throwing nozzles have been used. All debris resulting from clearing, including brush piles, logs and coconut husks, should be burned or hauled away. Sulfur, DDT, or dimethyl phthalate may be used in decontaminating the area as recommended under the section on miticides. In use, the dust or spray should be applied to the ground, litter, and roots of the vegetation. Miticide that falls on the vegetation more than a few inches above the ground will have little effect on chiggers.

Maintenance of permanent control.—In order to prevent reinfestation, nesting and refuge places of rats should be destroyed or made inaccessible. Floors of tents and buildings should be raised a foot or more off the ground and the space beneath kept open and clear of trash. Unused buildings should be demolished. Stumps, rock piles, small coral outcroppings, and abandoned foxholes, all of which offer shelter to rats and breeding places for chiggers, should be removed or covered. If trees are left standing they should be made rat proof by placing a smooth metal band at least 10 inches wide around the trunk. Coconuts should not be allowed to accumulate above the bases of palm trees.

PERSONAL PROTECTION

Men can protect themselves from chigger bites by the methods described above in the section on miticides. They can further reduce the hazard of infection by avoiding areas which might harbor chiggers.

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Areas described above as being favorable chigger habitats should be shunned. If circumstances make it absolutely necessary to sit or lie down in these areas, bare rocks or open sand should be chosen. When sleeping, it is desirable, if at all possible, to keep off the ground. Jungle hammocks are preferable to bed rolls; cots are satisfactory, but when they are used on the ground a strip of cloth 1 inch wide should be dipped in dimethyl phthalate and wrapped around each leg.

GENERAL RECOMMENDATIONS

Training and discipline of military personnel is necessary for the success of any program that is instituted for the control of scrub typhus. Individual 2-ounce bottles of dimethyl phthalate should be made as accessible to the men as atabrine or salt tablets. It is suggested that a shelf of the bottles be placed near the mess line. Men who are required to live or work in suspected areas must be made to follow precautionary measures under supervision. Impregnation of blankets and clothing should be done by companies under supervision of officers who understand the importance of the procedure.

Troops should not be moved into a new area until a preliminary survey has shown that danger from scrub typhus is negligible or until control measures have been carried out. Where preliminary surveys are impracticable, as in combat and patrol operations, men should be equipped with freshly impregnated clothing and blankets and should be drilled in the precautions to be observed in the use of dimethyl phthalate and the choice of resting and sleeping places.

Each method of impregnation of clothing has its advantages. The spray and smear methods introduce the dimethyl phthalate so that it is not readily washed out by water, but even distribution of the miticide is difficult to obtain. The emulsion method of impregnation assures even distribution of dimethyl phthalate, but careful drying is required and immersion in cold water readily removes the dimethyl phthalate. No one method can be recommended as best in all situations.

Control measures should not be relaxed until all sign of rodent and chigger infestation of a camp has disappeared. Constant vigilance and quick action are necessary to keep rats from re-establishing themselves and thus introducing chiggers in a cleared area.

Officers and men making scrub typhus surveys are especially exposed to the risk of infection, and should follow precautionary measures without fail. It is recommended that survey and control parties be carefully selected and allowed to devote their full time to the work.

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COVER PHOTOGRAPH

While the pert little parakeet seems to be bewildered by the whole affair, two industrious patients enjoy one of the selected hobbies offered at a West Coast Naval Hospital. The scene is in the Arts and Crafts Department of the local American Red Cross Unit. Smoothing out pieces of plastic helps smooth out some of the rehabilitation problems encountered in Naval hospitals.

—Official U. S. Navy photo.

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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

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PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

With the establishment of the Dental Corps in 1912, the function of the BULLETIN was broadened to serve in a similar capacity for members of that Corps.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

LOUIS H. RODDIS, *Editor*,
Captain, Medical Corps,
United States Navy.

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Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

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All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

LOUIS H. RODDIS, *Editor*,
Captain, Medical Corps,
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U. S. NAVAL MEDICAL BULLETIN

VOL. 46 APRIL 1946 NO. 4

SPECIAL ARTICLES

DYSENTERY OUTBREAK ABOARD NAVAL VESSELS IN SAN PEDRO BAY, PHILIPPINE ISLANDS[1]

FRANCIS S. CHEEVER
Commander (MC) U.S.N.R.

During the summer of 1945 an outbreak of dysentery occurred in personnel aboard ships of the United States Navy anchored in San Pedro Bay at the head of Leyte Gulf, Philippine Islands. The disease made its appearance in late June, reached its first peak in early July, and after a temporary remission, attained a second peak in mid-August. Thereafter a marked if somewhat uneven decline occurred, and by mid-September only sporadic cases were being reported.

During the period between 1 July 1945 and 3 September 1945, cases of dysentery were reported on approximately 150 ships. The actual number of cases that occurred was, in all probability, considerably higher than reported, since a uniform reporting system was not instituted until relatively late in the course of the epidemic. Furthermore it seems likely that a number of mild, ambulatory cases escaped detection. Although the rapid movement of ships in and out of Leyte Gulf made it impossible to estimate the number of men present in the area during this period, it appeared that less than 20 percent of the ships lying at anchor became infected with the disease.

This report deals with the etiology of the disease, its clinical aspects, and with the epidemiology of the outbreak and the efficacy of some of the preventive measures employed.

ETIOLOGY

The epidemic was primarily one of bacillary dysentery. In all, 1,058 rectal swab cultures were made from patients hospitalized for

[1] From Naval Medical Research Unit No. 2.

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dysentery, and 433 or 40.9 percent were positive for organisms belonging to the genus shigella. Nearly all the patients had received some chemotherapy before it was possible to make cultures and many were actually convalescent at the time. The type incidence of causative organisms is given in table 1.

TABLE 1.—*Type incidence of shigella organisms*

Type	Number	Percentage
Shigella flexneri III (VIII)	426	98.3
Shigella flexneri II	2	.5
Shigella flexneri V	2	.5
Shigella alkalescens	3	.7
Total	433	100.0

The prevailing type, Shigella flexneri III (VIII), appeared to be a strain of type III which possessed, in addition, various amounts of the antigen characterizing type VIII. In some instances it was difficult and even impossible to demonstrate the "minor" antigen in freshly isolated organisms, but after they were subcultured it was usually possible to prove that such an antigen was present. In no case was a pure type VIII isolated.

A few cases of amebic dysentery were detected. A stool specimen from each of 130 consecutive cases of clinical dysentery was examined for the presence of ova and parasites; in 3 instances vegetative forms of Endamoeba histolytica, large race, were observed, and in 2 additional cases cysts or vegetative forms of E. histolytica, small race, were noted. Amebic dysentery played a minor role in this outbreak.

CLINICAL DATA

The course of the disease was relatively mild in most instances, and clinical cure within a week was the general rule. Chronic cases were few. In typical cases the onset of disease was sudden, with abdominal cramps followed in a few hours by a series of loose, watery stools. These usually contained mucus, but gross blood was rarely observed. Nausea was an occasional complaint, but vomiting occurred in only a few instances. The admission temperature varied from 102° F. in severe cases to normal in mild ones. The fever tended to increase during the first 24 hours, but by the third or fourth day had usually returned to normal at a time when bowel movements were assuming a semiformed character.

By the end of a week, the average patient was clinically well. In a few instances diarrhea continued through the second week and was occasionally accompanied by a secondary rise in temperature which lasted for several days. Relapses were encountered. Among the

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patients admitted for dysentery to the sickbay of one destroyer tender, 21 or 4 percent were readmissions. The majority of these turned in for the second time within a few days of being released from the hospital after their first attack. True second attacks appeared to be rare.

Nearly all patients received chemotherapy; sulfadiazine, sulfaguanidine, and sulfathiazole were used in the order of frequency mentioned. There was no demonstrable difference in the clinical response to the three drugs. The majority of medical officers believed that chemotherapy was of some benefit to the patient, but since no control series was available for comparison, it was impossible to settle this point. In the few instances in which it was impossible to give chemotherapy because of a history of previous sensitization to sulfonamide compounds, the attending medical officers believed that these untreated cases did about as well as did those in which specific therapy was given. The inherent mildness of the disease added a further difficulty in evaluating the efficacy of chemotherapy. The usual supportive measures were used. Bismuth and paregoric were administered for cramps, and dehydrated patients received parenteral fluids. The intravenous administration of 1,000 milliliters of 5-percent dextrose in physiologic saline solution usually resulted in a rapid improvement in the patient's subjective condition; that is, relief of thirst, disappearance of headache and malaise, and frequently a fall in temperature. Patients whose fever continued for 72 hours or more seemed greatly benefited by the administration of plasma; this observation was made independently by a number of medical officers.

Three deaths were recorded, two due to hemorrhagic nephritis attributed to sulfadiazine, and one due to toxic myocarditis complicating a case of combined bacillary and amebic dysentery. Complete pathologic reports were not available.

It was impossible to determine the average incubation period, but from epidemiologic data presented in the next section, it appears that it might be as short as 48 hours.

EPIDEMIOLOGY

Source.—The most probable source of the original infection appeared to be the native population ashore. Bacillary dysentery of the Flexner variety is known to be endemic in this area of the Philippines. Two native physicians on the staff of the Leyte Provincial Hospital were interviewed. They reported that bacillary dysentery reached its peak in this region during the months of July and August, and that there were a number of cases present in the neighborhood at the moment. The village of San Antonio (close to the beach recreation area) on Samar was visited in July. The mayor reported

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a moderate number of dysentery cases in the village at that time, and feces of a diarrheal character were noted around the dwellings. Rectal swab cultures were obtained from 45 natives who had recently had diarrhea. Five or 11.1 percent were positive for Shigella flexneri III (VIII); that is, the same type that was isolated from cases occurring in the fleet.

One argument advanced against this hypothesis was the fact that shore-based activities had a low incidence of dysentery during this period; in fact, ever since they had landed on Leyte and Samar 9 months previously. This had obtained despite the fact that there had been intimate contact with the natives during this time. Some shore-based units did suffer heavily shortly after their arrival; more than 50 percent of one Naval construction battalion was said to have suffered from "diarrhea" during the first 2 months after their arrival on Samar, and two units on Jinamoc Island, respectively, reported monthly rates of 104 and 119 per 1,000 for cases of dysentery during their first month ashore. It is possible that considerable immunization by means of subclinical infections took place in shore-based personnel. Furthermore the excellent sanitary standards maintained by shore establishments undoubtedly did much to prevent the development of secondary cases.

Spread from shore to ship.—This may have taken place by several routes. In June and early July the sale of native foods and fruit juices was permitted at the recreation beaches. Men on liberty were allowed to visit the native villages. Food was brought ashore for consumption on the beach, where at first flies were numerous. Bumboats plied the anchorage and sold food and drink directly to the ships. Swimming was permitted in areas almost certainly polluted by sewage discharges from nearby native villages. Probably all these routes played some part in the spread of the infection from shore to ship.

Inter-ship spread.—The strict precautions ordered in early July were aimed at eliminating the sources of infection outlined, and from 7 July on it seemed unlikely that more than an occasional man acquired his infection directly from shore. A temporary decline in the incidence of the disease was noted, but by the end of July the curve had turned sharply upward again and it seemed obvious that inter-ship infection was occurring. Two probable means of spread were (1) by polluted harbor water and (2) by personal contact.

The tide range in Leyte Gulf was small and there was little demonstrable current. Winds were light. Boxes thrown over the side would float alongside for hours. With so many ships present, it was inevitable that heavy fecal contamination of the water should take place. Excreta from dysentery patients were poured into the harbor water. In one instance Shigella flexneri III (VIII) was isolated from a

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sample of sea water obtained 30 feet off the stern of a destroyer escort which had 35 cases of dysentery on board. The directives of 7 July prohibited the use of salt water aboard ships; nevertheless newcomers to the anchorage occasionally used harbor water for washing, scrubbing, showers, or cleaning vegetables for a few hours before they became aware of the situation. All fresh water made by evaporators on the various ships was ordered chlorinated as an additional safeguard, and so far as could be determined this was faithfully carried out. It was impossible to incriminate fresh water in any instance, although the case of one auxiliary personnel destroyer represents a possible exception.

This ship (with normal complement of 150 men) had been in and out of San Pedro Bay since 18 July. The proper sanitary regulations had been followed and the ship remained free of the disease for nearly a month. On 4 August her evaporators broke down and water was obtained from water barges and other ships. Since presumably only chlorinated water was furnished, further chlorination was not carried out by this ship. Water rationing was instituted and neither showers nor washing of clothes was permitted for a week. During this time, unidentified members of the crew resorted to surreptitious salt-water baths. On 8 August, 27 passengers came aboard for the mail trip. These men came from various ships and shore facilities and were not suffering from diarrheal disease at the time. Water at this time was being rationed to enlisted personnel and passengers by means of a bucket and common drinking cup.

On 9 August the passengers were transferred because of the water shortage, and the ship received 500 gallons of water from a cruiser which had cases of dysentery aboard at the time. The ships were tied up together for 1 hour; no exchange of food took place, no one from the smaller vessel boarded the cruiser, and only one officer from the cruiser boarded the former ship. The cruiser's water was being adequately chlorinated at the time, and apparently the water was rechlorinated aboard the auxiliary personnel destroyer as an additional safeguard. The sequence of events is shown in table 2. It was impossible to determine whether the cruiser or the transients were the actual source of infection.

Small-boat crews were particularly exposed to infection from polluted harbor water, since their work frequently brought them into contact with spray, wet lines, etc. Figures from two auxiliary personnel lighters, used to house small-boat pool personnel, showed a significantly higher incidence in the men assigned to work in small boats as compared with those who carried out their duties aboard the mother ship, even though the two groups were living together (tables 3 and 4).

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TABLE 2.—*Auxiliary personnel destroyer dysentery cases*

Date (August)	Number of cases	Remarks	Date (August)	Number of cases	Remarks
4	0	Evaporators out of commission.	12	15	
5	0		13	18	
6	0		14	1	
7	0		15	1	Evaporators working, ship left San Pedro Bay.
8	0	27 passengers came aboard.			
9	0	Passengers put ashore. Water taken from cruiser.	16	1	Shigella flexneri III (VIII) isolated from patients on both ships.
10	0				
11	5				

TABLE 3.—*Dysentery cases aboard auxiliary personnel lighter A, 26 June to 26 August 1945*

Group	Number	Cases of dysentery	Percentage
Small-boat operators	567	288	57
APL ship's company	100	40	40
Total	607	328	54

TABLE 4.—*Dysentery cases aboard auxiliary personnel lighter B, 26 June to 26 August 1945*

Group	Number	Cases of dysentery	Percentage
Small-boat operators	440	184	42
APL ship's company	150	34	23
Total	590	218	37

The experience of auxiliary personnel lighter C is instructive. She housed stevedores who were engaged in unloading ammunition from other ships. Within 4 days of their arrival on board, dysentery broke out among them and continued to spread in spite of rigorous sanitary precautions. Inspection of the ship revealed that the heads for the stevedores consisted of troughs that were constantly flushed by streams of salt water. This water spattered on the seats and decks and contaminated the clothing and hands of the men. Furthermore the ship was anchored in an eddy of grossly polluted water. The arrangement of the salt water inlets was changed, the pressure of water was lowered, and a man was stationed in the heads to swab down seats and decks with cresol solution as frequently as possible. The incidence of the disease fell sharply within 4 days of the institution of these measures. Small-boat personnel and stevedores, by the nature of their work, had excellent opportunities to spread the disease from one ship to another throughout the anchorage.

It is noteworthy that the only outbreak of dysentery reported by

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shore-based activities during this period occurred on the PT Base on Samar at the end of August. The causative organism was reported as Shigella flexneri III (VIII). The men of this base were engaged in patrol work in Leyte Gulf, where, like other small-boat personnel, they were exposed to spray and wet lines.

Small vessels frequently lay alongside tenders and repair ships for varying periods of time while necessary work was being carried out. Considerable intermingling of the crews took place and in some instances it was possible to detect the spread of infection from ship to ship. A few examples are given.

Destroyer tender A reported cases of bacillary dysentery during July and August. Destroyer escort B lay alongside for repairs to its engineroom from 1 August to 6 August 1945. Repairmen from the tender worked in the engine- and firerooms of the destroyer escort. On 5 and 6 August, 10 cases of dysentery occurred on the smaller ship. Seven of the 10 patients were engineroom personnel who had been working with the tender's repairmen. Shigella flexneri III (VIII) was isolated from cases on board both ships.

Destroyer tender B admitted 44 cases of clinical dysentery to her sickbay during the period between 1 and 12 August 1945. On 11 August destroyer A came in from Okinawa with no cases of dysentery aboard. Chlorination of water made by her evaporators was begun 4 hours before reaching port; no salt water was allowed on board. On 12 August she tied up alongside the tender for necessary repairs, and

TABLE 5.—*Dysentery cases aboard destroyer tender B, destroyer A, and destroyer escort C*

Date (August)	New dysentery admissions aboard—			Remarks
	Destroyer tender B	Destroyer A	Destroyer escort C	
10	4	.....	.....	
11	6	0	.....	Destroyer A entered San Pedro Bay.
12	8	0	.....	Destroyer A tied up alongside destroyer tender B.
13	14	0	.....	
14	4	6	.....	
15	16	8	.....	
16	15	10	.....	
17	12	28	.....	
18	10	19	.....	
19	10	26	.....	
20	18	(1)	0	Destroyer escort C entered San Pedro Bay and tied up alongside destroyer A.
21	19	11	0	Destroyer escort C moved alongside destroyer tender B, as destroyer A entered drydock.
22	15	11	0	
23	15	11	0	
24	16	13	0	
25	33	9	1	
26	16	6	9	
27	12	3	20	
28	13	0	5	
29	12	1	5	
30	8	2	.....	Destroyer escort C put to sea.
31	18	0	.....	

[1] Not recorded.

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immediate mingling of both crews took place, particularly at ship's service. Cases of dysentery began to appear on the destroyer on 14 August. Six days later, destroyer escort C tied up alongside the destroyer, and when the latter moved to drydock she took a berth next to the tender. Except for necessary repairmen, all traffic between ships was forbidden; a police petty officer was placed at each gangway to enforce this. Six days later, cases of dysentery began to appear on board the destroyer escort. The sequence of events is shown in table 5.

Subsequently it was ascertained that landing ship tank A had tied up alongside destroyer escort C for 48 hours previous to the latter's departure from San Pedro Bay. Five days later, 12 patients with dysentery were admitted to the sickbay of landing ship tank A within 36 hours. Because she left San Pedro Bay the following day, further information could not be obtained.

These cases exemplify the important role which tenders and repair ships played in the dissemination of the disease about the anchorage. The nature of their work brought them into contact with many other ships, infected or otherwise, and once the disease had established itself aboard a vessel of this nature, there were countless opportunities to introduce the infection into new ships. Furthermore the vital nature of the work carried out by these craft precluded the possibility of quarantining them.

Intra-ship spread.—Once the disease had gained a firm foothold on a ship, it proved difficult to arrest its further spread until considerable percentage of the personnel had come down with dysentery. The disease was extremely infectious on shipboard, and in many instances failure of supply of the human host (comparative lack of susceptible subjects) appeared to be at least as important in bringing the epidemic to an end as did the heroic sanitary measures employed.

Infected food handlers presented an obvious possibility as a means of spread. One thousand sixty-three rectal swab cultures were taken from food handlers on infected ships, and 45 (4.2 percent) were positive for Shigella flexneri III (VIII). These carriers were presumably healthy, although at least 2 of them were known to have suffered from dysentery during the preceding 2 months. Food handlers excreting enteric pathogens in their stools were promptly removed from mess duty and placed under treatment. It is impossible to evaluate the role played by infected food handlers in disseminating the disease. Their removal from mess duty was in no instance followed by a significant reduction in new cases. In one instance, however, food handlers appeared to be definitely connected with the spread of the disease. Very few officers on one heavily infected battleship came down with dysentery during the early stages of the outbreak. Ultimately, however, several wardroom mess attendants incurred the disease at

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about the same time, and, according to the senior medical officer, a number of cases occurred among the commissioned officers within the next week. It must also be pointed out that it was not often possible to make cultures on excreta from any one ship's food handlers more than once, and hence a number of carriers were undoubtedly missed who might have been picked up on repeated examinations.

The persistent spread of infection within given ships led to the belief that personal contact played an important role. All ships were crowded because of wartime conditions, some carrying as high as 150 percent of the complement for which they were designed. The ban on salt water put an additional load on the already limited supply of fresh water, and in some ships it was necessary to institute water hours. Overcrowding and limited fresh water available for general sanitary purposes gave the disease many chances to spread. The general course of the epidemic was a gradually rising one, as would be expected if casual contact with men whose hands or clothing had been soiled with fecal material were to blame. As compared with enlisted men, officers tended to contract the disease later in the course of the epidemic and in fewer numbers. One explanation for this may have been the less crowded conditions under which officers lived and the more adequate sanitary facilities available to them.

The convalescent carrier represented another probable means of spread. Strict isolation of more than a few patients aboard a crowded warship is impossible. The approved practice for releasing dysentery patients is that they shall be symptom free for 2 weeks, during which time at least five cultures must be taken to insure that the patient is not a carrier. Chemotherapy further complicates the picture, in that negative cultures obtained within 5 days of stopping the specific drug are viewed with suspicion. Neither space nor time was available aboard these ships for carrying out such a controlled convalescence. Most vessels lacked facilities for bacteriologic work and those possessing them were so hard-pressed that one negative culture per man was the rule. Since this was usually taken before or shortly after discontinuing chemotherapy, undoubtedly many masked carriers were missed.

The usual rule was to discharge a man to duty after he had been free of symptoms for 48 hours. Aboard the destroyer tender B we were able to follow some patients for as long as 5 days after they were entirely free from symptoms and obtained positive cultures from them; this was accomplished despite sulfadiazine therapy in full doses. The standard precept that no food handler should be allowed to return to duty until 3 months after recovery from his acute attack was also ignored because of the manpower situation.

Opportunity arose to take a number of rectal swab cultures aboard

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TABLE 6.—*Destroyer tender B dysentery cases*

Group	Number of cultures	Number positive	Percentage
Patients at all stages, acute and convalescent	447	172	38.4
Food handlers	200	19	6.5
Patients released from hospital less than 3 days previously	98	6	6.1
Patients released from hospital more than 3 weeks previously	67	0	0
Normals: No history of diarrhea during outbreak	105	2	1.9

TABLE 7.—*Destroyer tender B dysentery cases by divisions*

Division	Type of work	Percentage
1	Deck	45.9
2	Deck	75.6
3	Repair (other ships)	55.6
E	Electricians	51.3
F	Gunnery	46.8
H	Sickbay	45.8
N	Signalmen	52.7
R	Repair (own ship)	52.3
S	Stewards and ship's cooks	46.7
Total		53.8

destroyer tender B which had many cases of dysentery between 1 August and 15 September 1945. The results are given in table 6.

Cases were further broken down by divisions as shown in table 7.

Division 2 showed a rate 20 percent higher than any other division. However since Division 1 which did the same type of work had the lowest attack rate, the significance of this finding is not clear. The crew was not fed or berthed by divisions.

Attempts were made to isolate the specific organism from the fingers and buttocks of patients suffering with acute dysentery. A swab moistened in tryptose phosphate broth or saline solution was rubbed over the area and then used to streak an S-S agar plate. Particular attention was paid to fingernails. In no instance was a shigelliform organism isolated from material cultured from the fingers of the 16 patients, even though several of them had just defecated and had not washed their hands. Positive cultures were obtained from specimens from the buttocks of 5 of 7 patients immediately after defecation. These were taken from the area lying between the anus and the ischial tuberosities; culture specimens taken peripherally to this were negative.

Similar attempts were made to isolate the causative organism from stanchions, doorknobs, handles of water faucets, and ladder rails in the sickbay of destroyer A at the height of her outbreak. At the same time cultures were made from specimens from toilet seats and stanchions in the crew's head aboard the ship. In the only positive culture obtained the organisms had been taken from a stick used to push fecal matter down the clogged trough of the head.

Flies, polluted harbor water, and drinking water obtained by means of evaporation deserve comment at this point.

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Flies are traditionally associated with epidemics of bacillary dysentery and have undoubtedly played a major role in the spread of the disease in many outbreaks. In the present instance flies may have been one of the factors serving to pass the infection from the natives to the sailors on the beach in late June. In the anchorage itself, however, flies were extremely rare (two were seen during a 10-day stay on destroyer tender B); they appeared to have played no part in the inter- and intra-ship spread of the disease during July and August.

Drinking water obtained by distillation of the heavily polluted harbor water came under suspicion. With a triple- or double-effect low-pressure evaporator it is possible to lower the pressure to a point where the water boils at a temperature considerably below 212° F. In most ships, however, the temperature does not fall below 180° F. It is hardly possible that enteric organisms could survive such treatment. It is theoretically possible, however, that a small amount of salt water could be sucked over without being detected, but this seems extremely unlikely.

There are two kinds of evidence against the theory that the disease was spread in this way. First, with the possible exception of the auxiliary personnel destroyer A, the epidemiologic picture of the development of the disease on any given ship was not compatible with a massive water-borne infection. Second, no record of a positive C–A test on distilled water before chlorination was brought to our attention, although a number of tests were made by various ships. For example, one repair ship had spent 5 months in polluted anchorages where definite fecal contamination of the harbor water was known to exist. During this period, 20 parallel tests were made on the salt water entering the condensers and on the distilled water leaving them before chlorination.

All samples of sea water examined yielded positive results for the presence of members of the colon-aerogenes group; all the corresponding tests on the samples of freshly distilled water yielded negative results. While it appears that low-pressure evaporators, if properly run, will not permit the survival and passage of enteric organisms, no chances should be taken, and all fresh water obtained by distillation of polluted sea water should be adequately chlorinated.

Polluted harbor water appeared to have played a major role in the spread of the disease. That dysentery bacilli may survive in sea water for at least 2 days, and probably longer, was shown by the following experiment. A sample of sea water was obtained from an area known to be free from fecal pollution. Repeated cultures of this sample revealed no organisms belonging to the shigella, salmonella, or colon-aerogenes group. Five hundred milliliter portions of this sample were inoculated with 0.5 milliliter of 18-hour broth cultures

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of various strains of dysentery bacilli. The flasks were placed outdoors where they were exposed to sunlight for several hours each day. The temperature did not fall below 70° F. Cultures were taken every 4 or 8 hours; the pour plate method was used. The results are summarized in table 8.

TABLE 8.—*Survival of dysentery bacilli in sea water*

Time in hours after inoculation	Shigella flexneri III (stock culture)	Shigella flexneri VIII (stock culture)	Shigella flexneri III (VIII) (strain 1 *)	Shigella flexneri III (VIII) (strain 2 *)
0	+	+	+	+
4	+	+	+	+
8	+	+	+	+
12	+	+	+	+
16	+	+	+	+
20	+	+	+	+
24	+	−	+	+
28	+	−	+	+
32	+	−	+	+
36	+	−	+	+
40	+	−	+	+
44	+	−	+	−
48	+	+	+	+
52	+	−	+	−
60	+	−	+	−
68	+	−	−	−
76	+	−	−	−
84	−	−	−	−
92	−	−	−	−

* Both strains of Shigella flexneri III (VIII) were isolated from patients during the San Pedro Bay outbreak.

The discharge of large masses of untreated sewage into a circumscribed anchorage presenting little movement of water creates a potential health hazard which may (as in the case of San Pedro Bay) become a definite and serious problem. Ideally all sewage should be treated with chlorine or chlorine compounds before being discharged, but in the case of the modern warship it would be difficult to obtain the necessary space for tanks and other equipment.

CONTROL MEASURES

The usual control measures were instituted early in the course of the outbreak. The recreation areas ashore were greatly improved, and all sanitary hazards removed or corrected. Natives were no longer allowed in these areas, and the local villages were declared out of bounds. Swimming was prohibited, no food was permitted to be brought in from ships for consumption on the beach, and the sale of native food and drink was forbidden. All ships entering the anchorage were informed of the situation and were given specific instructions concerning the sanitary precautions to be followed. No bumboats were allowed to approach the ships.

All fresh water made by the evaporators of the fleet was ordered chlorinated, and the use of salt water aboard for anything but flushing

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out sanitary systems was forbidden. The serving of uncooked vegetables was discouraged. Ships reporting more than 10 cases of dysentery were usually put in restrictive quarantine. Traffic between infected tenders and ships tied up alongside was limited to men on official business. Constant efforts were made to improve sanitary conditions and personal hygiene aboard individual ships. As many food handlers as possible were examined and those yielding positive cultures were removed from mess duty and placed under treatment.

It is impossible to evaluate the part played by any one of these general control measures in checking the spread of the disease. On the whole they appeared to be more effective in preventing the introduction of dysentery into new ships than in limiting the spread of infection within a given vessel.

Chemoprophylaxis was instituted on a number of ships. Sulfadiazine was used almost exclusively; the usual dose was 1 gm. daily for a period of from 10 days to 6 weeks. Occasionally larger doses were given for shorter periods of time. The results were inconclusive, since the drug was given in conjunction with other control measures and frequently not until the peak of the epidemic was past. With one exception, comparable control groups were not set up. Most medical officers reported that chemoprophylaxis had no demonstrable effect in checking the spread of the disease. An occasional ship reported a decrease in incidence after the institution of sulfadiazine prophylaxis.

Aboard the auxiliary personnel lighter D, the ship's company received 1 gm. of sulfadiazine 4 times a day for 6 weeks. During the same period stevedores living aboard but working on other ships (infected and otherwise) did not receive the drug. Twenty percent of the ship's company was admitted to the sickbay for dysentery during this period as opposed to 28 percent of the stevedores. The difference is not statistically significant.

A possible explanation for the relative inefficacy of sulfadiazine prophylaxis was that the specific organism was drug fast, at least during the latter part of the epidemic. This hypothesis was subjected to experimental proof.

Six strains of Shigella flexneri III (VIII) were selected. All six were obtained in September from patients aboard the destroyer tender B who were receiving sulfadiazine therapy at the time of culture. As controls, five stock cultures of Shigella flexneri (various types) brought out from the United States, and a sixth strain obtained on Okinawa, were used. The patient from whom the last strain was obtained was known not to have received chemotherapy. The sources of the first five cultures are not known. With one exception, these organisms grew well in the inhibitor-free broth medium employed.

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The following serial dilutions of sulfadiazine were made in the inhibitor-free broth: 1:5,000; 1:10,000; 1:20,000; 1:40,000; 1:80,000; 1:160,000; 1:320,000; and 1:640,000. These were tubed in 2-milliliter amounts, and control tubes containing no sulfadiazine were set up for each culture. The inoculation for each tube was 0.1

TABLE 9.—*Drug fast experiment with San Pedro Bay strains*

Strain and concentration of sulfadiazine	Hours after inoculation					
	4	6	8	10	12	14
S. flexneri III (VIII) Marshall:						
1:5,000	−	−	±	+++	++++	++++
1:10,000	−	−	±	+++	++++	++++
1:20,000	−	−	−	+++	++++	++++
1:40,000	−	−	−	++	+++	++++
1:80,000	−	−	−	+++	++++	++++
1:160,000	−	−	±	++++	++++	++++
1:320,000	−	−	±	++++	++++	++++
1:640,000	−	−	±	+++	++++	++++
Control	−	−	±	+++	++++	++++
S. flexneri III (VIII) Jalbert:						
1:5,000	−	−	−	++	+++	++++
1:10,000	−	−	−	++	+++	++++
1:20,000	−	−	−	++	+++	++++
1:40,000	−	−	±	+++	+++	++++
1:80,000	−	−	±	++++	++++	++++
1:160,000	−	−	+	+++	++++	++++
1:320,000	−	−	±	++	++++	++++
1:640,000	−	−	±	+	+++	++++
Control	−	−	+	++++	++++	++++
S. flexneri III (VIII) Reese:						
1:5,000	−	−	+	+++	++++	
1:10,000	−	−	±	+++	++++	
1:20,000	−	−	±	+++	++++	
1:40,000	−	−	±	+++	++++	
1:80,000	−	−	±	+++	++++	
1:160,000	−	−	±	+++	++++	
1:320,000	−	±	++	++++	++++	
1:640,000	−	±	++	++++	++++	
Control	−	±	++	++++	++++	
S. flexneri III (VIII) Eby:						
1:5,000	−	−	−	++	++++	++++
1:10,000	−	−	−	++	++++	++++
1:20,000	−	−	±	+++	++++	++++
1:40,000	−	−	−	++	++++	++++
1:80,000	−	−	−	++	++++	++++
1:160,000	−	−	−	+	++++	++++
1:320,000	−	−	±	++	++++	++++
1:640,000	−	−	−	+	+++	++++
Control	−	−	+	++	++++	++++
S. flexneri III (VIII) Panos:						
1:5,000	−	−	±	+++	+++	++++
1:10,000	−	−	±	+++	+++	++++
1:20,000	−	−	−	+++	+++	++++
1:40,000	−	−	±	+++	+++	++++
1:80,000	−	−	−	+++	+++	++++
1:160,000	−	−	±	++	+++	++++
1:320,000	−	−	−	+++	+++	++++
1:640,000	−	−	±	++	+++	++++
Control	−	−	++	+++	++++	++++
S. flexneri III (VIII) Horton:						
1:5,000	−	−	+	++++		
1:10,000	−	−	+	++++		
1:20,000	−	−	+	++++		
1:40,000	−	−	++	++++		
1:80,000	−	−	++	++++		
1:160,000	−	−	++	++++		
1:320,000	−	±	++	++++		
1:640,000	−	±	+++	++++		
Control	−	±	+++	++++		

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milliliter of a 1 : 1,000 dilution of a 10-hour broth culture of the appropriate strain. The results are shown in tables 9 and 10. As compared to our stock strains, all the S. flexneri III (VIII) cultures isolated in

TABLE 10.—*Drug-fast experiment (stock strains)*

Strain and concentration of sulfadiazine*	Hours after inoculation									
	4	6	8	10	12	14	24	36	48	72
S. flexneri I (USA):										
1:5,000	−	−	−	−	−	−	−	−	−	−
1:10,000	−	−	−	−	−	−	−	−	−	−
1:20,000	−	−	−	−	−	−	−	−	−	−
1:40,000	−	−	−	−	−	−	−	−	−	−
1:80,000	−	−	−	−	−	−	−	−	−	−
1:160,000	−	−	−	−	−	−	−	−	−	−
1:320,000	−	−	−	−	−	−	−	−	−	−
1:640,000	−	−	−	−	−	−	−	++++	++++	++++
Control	−	+	+++	++++	++++	++++	++++	++++	++++	++++
S. flexneri II (USA):										
1:5,000	−	−	−	−	−	−	−	−	−	−
1:10,000	−	−	−	−	−	−	−	−	−	−
1:20,000	−	−	−	−	−	−	−	−	−	−
1:40,000	−	−	−	−	−	−	−	−	−	−
1:80,000	−	−	−	−	−	−	−	−	−	−
1:160,000	−	−	−	−	−	−	−	−	−	−
1:320,000	−	−	−	−	−	±	+++	++++	++++	++++
1:640,000	−	−	±	±	+	++	++++	++++	++++	++++
Control	−	+	++++	++++	++++	++++	++++	++++	++++	++++
S. flexneri III (USA):										
1:5,000	−	−	−	−	−	−	−	−	−	−
1:10,000	−	−	−	−	−	−	−	−	−	−
1:20,000	−	−	−	−	−	−	−	−	−	−
1:40,000	−	−	−	−	−	−	−	−	−	−
1:80,000	−	−	−	−	−	−	−	−	−	−
1:160,000	−	−	−	−	−	−	±	+++	++++	++++
1:320,000	−	−	−	+	+	++	++++	++++	++++	++++
1:640,000	−	−	±	+	++	+++	++++	++++	++++	++++
Control	−	±	++++	++++	++++	++++	++++	++++	++++	++++
S. flexneri IV (USA):										
1:5,000	−	−	−	−	−	−	−	−	−	−
1:10,000	−	−	−	−	−	−	−	−	−	−
1:20,000	−	−	−	−	−	−	−	−	−	−
1:40,000	−	−	−	−	−	−	−	−	−	−
1:80,000	−	−	−	−	−	−	−	−	−	−
1:160,000	−	−	−	−	−	−	−	−	−	+++
1:320,000	−	−	−	−	−	−	−	−	−	++++
1:640,000	−	−	−	−	−	−	−	+++	++++	++++
Control	−	+	++++	++++	++++	++++	++++	++++	++++	++++
S. flexneri VIII (USA):										
1:5,000	−	−	−	−	−	−	−	−	−	−
1:10,000	−	−	−	−	−	−	−	−	−	−
1:20,000	−	−	−	−	−	−	−	−	−	−
1:40,000	−	−	−	−	−	−	−	−	−	−
1:80,000	−	−	−	−	−	−	−	−	−	−
1:160,000	−	−	−	−	−	−	−	−	−	−
1:320,000	−	−	−	−	−	−	−	−	−	−
1:640,000	−	−	−	−	−	−	−	−	−	−
Control	−	−	−	−	−	−	−	++++	++++	++++
S. flexneri II (Okinawa):										
1:5,000	−	−	−	−	−	−	−	−	−	−
1:10,000	−	−	−	−	−	−	−	−	−	−
1:20,000	−	−	−	−	−	−	−	−	−	−
1:40,000	−	−	−	−	−	−	−	−	−	−
1:80,000	−	−	−	−	−	−	−	−	−	−
1:160,000	−	−	−	−	−	−	−	−	−	−
1:320,000	−	−	−	−	−	−	+	++++	++++	++++
1:640,000	−	−	−	+	++	++++	++++	++++	++++	++++
Control	−	++	++++	++++	++++	++++	++++	++++	++++	++++

*Comparable results were obtained when sulfathiazole was substituted for sulfadiazine.

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San Pedro Bay were distinctly resistant to the bacteriostatic action of sulfadiazine.

It appears probable that in the course of chemotherapy or chemoprophylaxis with sulfadiazine or sulfathiazole, dysentery bacilli can become drug fast. This possibility, with its therapeutic and epidemiologic implications, should be carefully considered before mass chemoprophylaxis is instituted.

SUMMARY

During the months of July and August 1945 an outbreak of bacillary dysentery occurred on ships of the Third Fleet and Service Squadron 10 anchored in San Pedro Bay, Philippine Islands. More than 6,000 cases were reported during this period. The etiologic agent was Shigella flexneri III (VIII). The disease was clinically mild and only 3 deaths were recorded.

The original focus of infection was apparently the native population. Naval personnel appeared to have become infected through contact with native food and drink, either ashore on the recreation beaches or afloat by patronizing bumboats. The subsequent inter-ship spread was probably caused by polluted harbor water (small-boat personnel being particularly hard hit) and by personal contact between the crews of two or more ships that were tied up together. Once the disease became established aboard a crowded ship, it proved extremely infectious and hard to control in spite of the usual sanitary measures. Infected food handlers, convalescent carriers, and subclinical cases probably contributed to the spread of the disease. Flies may have been involved in the genesis of the epidemic on the beach, but they played no role in the subsequent spread of the disease in the anchorage. No evidence was disclosed that fresh water obtained by distillation of harbor water was contaminated, and the epidemiologic picture was not one of massive water-borne infection.

Experimentally it was proved that strains of the specific organism recovered comparatively late in the epidemic could survive at least 2 days in sea water, and that they were relatively resistant to the bacteriostatic action of sulfadiazine and sulfathiazole. This property of drug fastness is one explanation for the noteworthy failure of chemoprophylaxis to check the epidemic.

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REPORT OF TWO HUNDRED NECROPSIES ON NATIVES OF OKINAWA

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A detachment from U. S. Naval Medical Research Unit No. 2, Guam, was sent to Okinawa early in the campaign to make a rapid survey of the native health conditions and to detect indigenous diseases which might be a hazard to service personnel. These investigations were conducted with limited equipment and material and under the exigency of combat. The present report is based upon the results obtained in 200 consecutive necropsies performed on natives of that island between 19 April and 12 June 1945, and includes gross and microscopic findings and data obtained from parasitic and bacteriologic surveys. The estimated native population on Okinawa was 400,000. It is recognized that 200 cases represent a sampling of 2 out of 4,000, which limits definite conclusions. However, the observations recorded at this time constitute considerable evidence concerning the health of Okinawan natives.

Immediate knowledge of diseases present was desired to be used in a number of ways; for example, (1) to check medical intelligence obtained prior to invasion, (2) to aid in the prevention and treatment of diseases in service personnel, (3) to aid in the treatment of native patients, (4) to obtain accurate information for death certificates, thereby enhancing the value of vital statistics, (5) to be used as leads for further medical investigations, and (6) to collect pathologic material for teaching and research.

The incidence and severity of diseases anticipated on the basis of medical intelligence were not evident in this group at this time. Deaths had been caused primarily from war casualties, resulting from gunshot wounds, burns, and inhalation of hexachlorethane smoke mixture, from emaciation and exposure, and from diseases which are not unlike those encountered in parts of the United States, with the exception that they were exaggerated by the hardships of war. The age and sex of the 200 Okinawan natives on whom necropsy was performed are shown in table 1.

Microfilariae bancrofti are found in the peripheral blood of approximately 30 percent of the Okinawan natives examined at night by means of the thick blood (20 cu. mm.) film method, but the incidence of elephantiasis is low. In the tissues from 200 necropsies these micro-

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TABLE 1.—*Age and sex of the 200 natives*

Group (years)	Number	Percentage	Male		Female	
			Number	Percentage	Number	Percentage
1–10	29	14.5	15	7.5	14	7.0
11–20	24	12	11	5.5	13	6.5
21–30	21	10.5	2	1.0	19	9.5
31–40	21	10.5	15	7.5	6	3.0
41–50	17	8.5	8	4.0	9	4.5
51–60	27	13.5	14	7.0	13	6.5
61–70	36	18	21	10.5	15	7.5
71–80	20	10	10	5.0	10	5.0
81–90	5	2.5	1	.5	4	2.0
Total	200	100	97	48.5	103	51.5

filariae were observed in 8 instances (table 2). They were seen in the capillaries of the myocardium, in the pulmonary veins and capillaries. in the capillaries of the glomeruli of the kidney, and in the sinusoids of the spleen. Circumscribed fibrosis surrounding the parasites in the spleen was the only morphologic reaction observed to the microfilariae present in the organs of the host. In all probability, longer and more diligent examination of sections cut from many more blocks of tissue from each organ would reveal a greater incidence of microfilariae. Filariasis was not found responsible for the death of any of the natives on whom necropsies were performed.

TABLE 2.—*Necropsy findings (Microfilariae)*

No.	Age	Sex	Primary cause of death	Location of microfilariae
1	12	F	Traumatic rupture of spleen; hemoperitoneum	Kidney.
2	13	F	Chemical pneumonitis (HC smoke)	Lung, kidney and spleen.
3	14	M	...do	Do.
4	15	F	Pseudomembranous laryngotracheobronchitis (HC smoke mixture).	Spleen.
5	16	M	Typhoid fever	Lung.
6	57	M	Syphilis	Myocardium.
7	18	M	Multiple gunshot wounds	Lungs.
*8	67	M	Burns	Spleen.

*Degenerated adult filarial worms in the left inguinal lymph node and elephantiasis of the scrotum were also present.

In this group of 200 cases, there were two of elephantiasis of the legs in males. Both patients were 71 years old and both died of multiple gunshot wounds of the chest. In the inguinal lymph nodes of one of these natives a degenerated adult filarial worm was seen. In addition to the cases already mentioned, another patient with elephantiasis of the scrotum was seen (No. 8 in table 2); a degenerated adult worm was found in the inguinal lymph nodes, and microfilariae were found in the spleen. In these three natives evidence of chronic fibrous lymphadenitis, funiculitis, orchitis, hydrocele, and elephantiasis dura of the scrotal skin was found. In two other instances the hydrocele present was believed to have been caused by filariasis (table 6).

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This work was done during the spring when malaria and encephalitis, both endemic to Okinawa, were not encountered. The incidence of infectious diseases, such as pneumonia and tuberculosis, was found to be comparable to the incidence in a people of similar economic and social status in the United States; the incidence of syphilis was less. Evidence of relatively acute, far advanced pulmonary tuberculosis, associated with generalization of the disease, was found in 7.5 percent. No evidence of chronic pulmonary tuberculosis was seen. Healed (?) primary calcareocaseous tuberculosis complexes were present in only 2½ percent, and caseous tuberculosis of pulmonary lymph nodes was encountered in 5 percent of bodies examined.

Enteric infections were relatively uncommon; there were 6 cases of bacillary dysentery, 1 of amebic dysentery, 1 of typhoid, and 1 undetermined. Bacteriologic examinations of the feces from the bodies of natives subjected to necropsy were not done. Information on the enteric pathogens present in a sampling of presumably healthy natives was obtained from a survey conducted by another member of the unit during the invasion. Rectal swab cultures from 443 presumably healthy natives revealed a carrier rate of 5 percent. The majority of organisms isolated belonged to the Flexner group; on Okinawa, as elsewhere in the Central and South Pacific, Shigella paradysenteriae flexneri II appeared to be the predominating organism. No strains of Shigella dysenteriae or Shigella ambigua were isolated. Salmonella typhi was isolated once, and Vibrio comma was not detected.

Intestinal parasites were common. Hookworm and ascaris infections predominated. About 50 percent of the bodies carried one or both of these parasites (table 3).

TABLE 3.—*Intestinal parasites found in the bodies of 200 natives of Okinawa*

Intestinal parasite	Number	Intestinal parasite	Number
Helminths		Protozoa—Continued.	
Hookworm*	102	Endamoeba: Continued	
Ascaris lumbricoides	85	Endolimax nana cysts	18
Enterobius vermicularis	4	Iodamoeba buetschlii cysts	3
Strongyloides stercoralis	23	Flagellates:	
Trichuris trichiura	9	Chilomastix mesnili	10
Protozoa		Enteromonas hominis	9
Endamoeba:		Trichomonas hominis	6
E. coli cysts	29	Girardia lamblia	9
E. histolytica cysts	14		

*Samples of hookworms found in 14 necropsies were submitted for identification. In 12 cases Necator americanus was the only species found; 52 Necator americanus and 2 Ancylostoma duodenale comprised the total of 54 worms collected.

A survey was made by a member of the unit of 639 apparently healthy natives for Endamoeba histolytica. He also examined fecal specimens from 195 of the natives on whom necropsies were performed. A single specimen from each case was examined; the results are shown

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in table 4. It should be noted that the incidence of infection is much higher in the living natives than in the dead. This discrepancy has been found by other workers and no adequate explanation has been given.

TABLE 4.—*Endamoeba histolytica found in fecal specimens*

	Number	Percentage
Total necropsy specimens	195	
E. histolytica, large race alone	5	2.6
E. histolytica, small race alone	6	3.1
E. histolytica, large and small races in same specimen	1	.5
Total specimens positive for E. histolytica	12	6.2
Total specimens positive for E. histolytica, large race	12	6.2
Total single specimens examined from apparently healthy natives	639	
E. histolytica, large race alone	23	3.6
E. histolytica, small race alone	50	7.8
E. histolytica, large and small race in same specimen	18	2.8
Total specimens positive for E. histolytica	91	14.2
Total specimens positive for E. histolytica, large race	41	6.4

Emaciation of a variable degree was present in almost all of the bodies examined. Pulmonary emphysema was frequently seen above middle life. Pulmonary anthracosis was a common finding in practically all lungs examined. The carbon deposits in the lungs probably resulted from the inhalation of wood smoke from fires universally built in the small, poorly ventilated, chimneyless homes. Evidence of a moderate degree of cardiac hypertrophy was found in both men and women. In some instances part of the cardiac enlargement was associated with pulmonary emphysema. The failure to find any evidence of severe arteriosclerosis was very striking.

The intestines of the Okinawans are longer than the intestines of the Caucasoid race in the United States. This was particularly true of the colon; it had a long mesentery, was redundant and frequently bound down by old fibrous adhesions. Evidence of mesenteric lymphadenitis was a common finding. All bodies examined had retained their vermiform appendixes, except one female native who was a naturalized citizen of the United States and had previously lived in Honolulu. These vermiform appendixes were not unusual; a few were bound down by delicate fibrous adhesions but there was no evidence of previous severe appendicitis, ruptured appendixes, abscesses or nonspecific perityphilitis. Pseudodiverticulosis coli was not found.

The rather frequent signs of mesenteric lymphadenitis, and evidence of minor degrees of cholangitis and pericholangitis with fatty changes of the liver, usually confined to the peripheries of the hepatic lobules, may have been related in some way to the large number of parasites found in the intestines.

All thyroid glands were small; no goiters were seen. The degenera-

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TABLE 5.—*Primary pathologic changes*

	Number		Number
Abscess, brain, traumatic	2	Leptomeningitis, purulent, traumatic	1
Burns	13	Mastoiditis	2
Carcinoma of breast, left	1	Nephritis, acute glomerulo-	2
Carcinoma of skin of neck	1	Pericarditis, fibrinous	1
Cirrhosis of liver	3	Peritonitis, posttraumatic	15
Colitis, ulcerative, bacillary	6	Placenta praevia centralis	1
Colitis, ulcerative, amebic	1	Pneumonia, broncho-	39
Colitis, ulcerative, type(?)	1	Pneumonia, lobar	6
Emaciation	28	Pneumonitis, chemical (HC smoke mixture)	7
Empyema, nonspecific	5	Rheumatic heart disease with mitral stenosis	1
Gangrene, pulmonary	4	Rupture, spleen, traumatic	1
Gunshot wounds (includes all forms of projectile metal)	193	Senility	10
Abdomen and pelvis	21	Syphilis, tertiary	1
Bones and joints, extremities	46	Tetanus (clinical diagnosis)	10
Thorax	22	Typhoid fever	1
Skull	7	Tuberculosis, pulmonary	13
Soft tissues only	34	Ulcer,* stomach, chronic, peptic	3
Multiple wounds	38	Ulcer,* duodenum, chronic, peptic	4
Single wounds	70	Ulcer,* duodenum, acute, perforating	1
Hemorrhage, brain, traumatic	1		
Infarct, brain, hemorrhagic	1		
Laryngotracheobronchitis, chemical (HC smoke mixture)	4		

* All peptic ulcer patients died as a result of hemorrhage.

TABLE 6.—*Contributory pathologic changes*

	Number		Number
Aortic stenosis, calcific	1	Rheumatic heart disease, with aortic and mitral stenosis, mild	2
Atelectasis, pulmonary	7	Rheumatic heart disease, with mitral stenosis	3
Empyema, tuberculous	1	Syphilitic aortitis	4
Gangrene of uterus	1	Thrombosis, dural sinuses (lateral, straight, and sigmoid)	1
Hemorrhage, adrenal, bilateral	2	Tuberculosis, miliary	7
Hepatitis, acute toxic	2	Tuberculosis, genito-urinary	2
Myocarditis, acute diffuse	1	Tuberculosis, intestinal	7
Nephritis, acute suppurative	1	Tuberculosis, laryngeal	1
Nephritis, chronic glomerulo-	7		
Pneumonia, hypostatic	8		
Pneumonia, typhoid	1		

TABLE 7.—*Incidental pathologic changes*

	Number		Number
Abscess, lung	1	Hepatitis	1
Abscesses, kidneys, nonspecific metastatic miliary	2	Hyperplasia of prostate, adenomatous	3
Adenoma, colon	1	Hypertrophy, urinary bladder, compensatory	3
Atherosclerosis, generalized	15	Interstitial myocarditis	2
Grade I	8	Leiomyoma, stomach	1
Grade II	5	Leiomyoma, uterus	2
Grade III	2	Lipoma	3
Coronary sclerosis, mild	2	Skin	1
Cholangitis	10	Jejunum	1
Cholecystitis, chronic	3	Retroperitoneal	1
Cholelithiasis	3	Nephrosclerosis, mild	4
Cholesterosis of gallbladder	5	Neurofibromatosis, multiple, with malignant schwannoma	1
Cystitis, acute	2	Osteomyelitis, chronic, skull	1
Cystitis cystica, chronic	5	Otitis media	2
Elephantiasis of legs	2	Renal lithiasis	2
Elephantiasis of scrotum (hydrocele)	5	Syphilitic aortitis	1
Emphysema, pulmonary	11	Tuberculosis, primary, calcareocaseous, complex, healed	5
Fatty change of liver	16	Tuberculosis, mediastinal, lymph nodes confined	10
Focal necrosis of adrenal glands	5	Tuberculosis, miliary, lungs	1
Focal necrosis of liver	5		
Focal necrosis of pancreas	2		
Hemorrhage, adrenal, unilateral	1		

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tive diseases such as cardiovascular-renal diseases, coronary heart disease, and osteoarthritic changes were rare.

Evidence of diseases of the internal female genitalia was absent: small leiomyomas of the uterus were seen only three times. Only three malignant growths were seen. One, in an adult male, was an epidermoid carcinoma of the neck. The other two were in women. One was a large ulcerating carcinoma of the left breast with only regional axillary metastasis; the other was a case of myxomatous degeneration of a large malignant schwannoma (neurogenic fibrosarcoma) of the buttock associated with multiple neurofibromatosis. A shell fragment had torn away a large part of this tumor.

Fungous infections of the skin were not observed. Dental hygiene was poor except in children and young adults. In middle-aged and older persons, what few teeth remained were reduced to carious snags. There were many edentulous mouths.

The majority of war wounds of the extremities were often complicated by infections, such as cellulitis, osteomyelitis, gas gangrene, and tetanus. Cerebral abscesses and purulent meningitis were complications of skull injuries. Chest, abdominal, and pelvic wounds were associated with fractures, perforations, penetrations, lacerations, hemorrhages, and infections.

In tables 5, 6, and 7 are listed the number of primary, secondary, and contributory pathologic changes based on autopsy findings in 200 bodies of Okinawan natives.

⚓ ⚓

A DEVICE FOR MAINTAINING REDUCED TEMPERATURE IN CASES OF IMMERSION FOOT

Immersion foot is not a frequent occurrence. However, prompt and proper treatment in the infrequent cases that do occur will save extremities. A means of maintaining low temperature was suggested and used by Commander Emmet L. Rixford (MC) U. S. N. R., while on my staff. The method is well worth dissemination.

An ordinary oxygen tent is used over the lower part of the body. Air instead of oxygen is forced into the canopy after being chilled by ice. The patient can move about in bed unhindered by cold cloths or ice bags. The extremities are kept cool and dry and the bedding does not require frequent changes. The temperature can be readily checked by the thermometer hanging in the canopy.

In simplicity and effectiveness as well as availability, this method of retarding metabolism in the lower extremities has proved hard to beat.—KRETZLER, H. H., Captain (MC) U. S. N. R.

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TROPICAL HEADACHE

PRELIMINARY REPORT ON DIAGNOSIS AND TREATMENT

WARD W. WOODS, M.D.
and
JACOB W. STUTZMAN
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Headache is one of the most common complaints encountered by the medical officer in the tropics. It is part of a tropical syndrome which is characterized by the following symptoms: Headache, usually bilateral and frontal; dizziness, especially on assuming the upright position; excessive perspiration; and mental depression.

Headache can be roughly classified into two main groups—inorganic and organic. Frequently there may be a combination of both. The inorganic type is usually recognized by the typical personality make-up and the vagueness and multiplicity of complaints. Specifically, the headache is usually described as generalized, continuous, and often bizarre in character, such as a "band of numbness," a "full feeling," "numbness at the top of my head," and the like. The true organic type most commonly seen in the tropics is characterized by specific location, throbbing type of pain, aggravation by exertion, heat, or direct sunlight, and relief by rest in the prone position and decrease of external temperature. Dizziness usually accompanies the headache and may be severe enough to become true syncope. Etiologic factors such as an error of refraction, infected sinuses or teeth, or fever must be ruled out. A posttraumatic or postconcussional syndrome may exactly duplicate the typical tropical syndrome.

The disturbed physiologic state underlying headache is still obscure, excluding ocular disturbances, focal infections, increased intracranial pressure, and specific lesions involving such pain-sensitive structures as the dura, venous sinuses, and large blood vessels.

It is our belief that the tropical syndrome, with its accompanying headache, results from a combination of one or more of the following factors: A hyperlabile vasomotor system as evidenced by postural hypotension, abnormal flushing or paling, and excessive perspiration; a decrease in intracranial pressure; and a biochemic imbalance such as a sodium chloride and calcium deficiency.

The following data have been compiled from examination of 20 young males all suffering from severe incapacitating headache for

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which no specific cause could be found. Results of neurologic, neuropsychiatric, ophthalmologic, otorhinologic, and general physical examinations were negative in all instances. Five patients had severe unilateral frontotemporal headaches. The remaining 15 patients had bilateral frontal headaches. All were made worse by a routine provocative test of violent exercise in hot sunlight and were improved by rest in the prone position. Ten patients, during an attack of headache, were placed in a walk-in refrigerator maintained at from 32° to 40° F. All were completely relieved of their headache within 15 minutes. The headache returned, although with less severity, within 30 minutes on reexposure to the normal tropical temperature.

The intracranial pressure was found to be decreased in all three men in whom lumbar puncture was done in the sitting position. In one the pressure was 50 mm. of water below the normal value as measured at the foramen magnum. The headache in these patients was relieved by increasing the intracranial pressure with intrathecal injections of from 5 to 10 cc. of normal saline solution. The severity of the headache was decidedly increased by lowering the pressure as little as 5 mm. below the original reading. All patients exhibited a pronounced vasomotor instability as evidenced by severe syncope and collapse of blood pressure during these procedures, especially on lowering the intracranial pressure.

Blood pressure levels after 15 minutes of rest in the prone position were normal in all cases as compared with a control group of similar age. On rapidly assuming a standing position, however, the group under study showed dizziness and a pronounced drop in blood pressure with striking decrease in the pulse pressure. The blood pressure drop was as great as from 104/64 in the prone position to 62/44 on standing. The control group failed to show this variation.

Occlusion of the common carotid artery by pressure against the carotid tubercle on the affected side produced great relief in the 5 cases of unilateral headache. On release of the pressure, the patients experienced a severe momentary exacerbation of their pain. Most of the patients with bilateral headache stated that the pain was decreased on the side of carotid occlusion, but intensified on the opposite side.

Jugular compression produced by a blood-pressure cuff about the neck, inflated to 35 mm. of mercury for 3 minutes, afforded relief in all but one patient with bilateral headache. In all five patients with hemicephalalgia the headache was made worse. It should be noted, in addition, that the dizziness on abruptly standing was prevented by jugular compression in all but one case.

The first trial of therapy in these 20 patients was increase of their salt intake by 4 gm. of sodium chloride four times daily, and administration of 0.66 gm. of calcium lactate three times daily. Fluids were

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increased to 4,000 cc. daily. In 8 of the 15 patients with bilateral headache, sufficient relief was obtained for return to full duty. This, after adequate check-up over at least a 2-week period, we have considered to be a clinical cure. None of the unilateral headache cases was improved by this therapy.

Of the five cases of unilateral frontotemporal headache, all were relieved by carotid occlusion on the affected side. Three were also relieved by occlusion of the temporal artery on that side just anterior to the tragus, and one by pressure over the supraorbital notch. The headache in this latter case was largely frontal. All five patients were made worse by provocative tests of heat and exertion, and by the jugular-compression test described above.

The three cases improved by temporal-artery compression were completely relieved with infiltration of 10 cc. of 1-percent procaine solution about the temporal artery and veins just anterior to the ear. Following this procedure the headache could not be produced by the provocative tests.

For this reason, under local anesthesia, resection of the temporal artery, veins, and periarterial tissues was performed through a 3-cm. vertical incision just anterior to the ear. It was noted at operation that traction or crushing of the temporal artery caused typical pain in the temporal region. When the periarterial tissues were stripped from the artery, traction or crushing of the vessel caused no symptoms, whereas stimulation of the periarterial tissues again produced the pain. Typical headache could also be reproduced by occluding the artery and distending it above the point of occlusion with an injection of normal saline solution. Following complete resection all previous symptoms of unilateral headache disappeared.

Resection of the supraorbital nerve and vessels at the notch resulted in clinical cure of the one patient with predominantly unilateral frontal headache.

The patient unrelieved by procaine infiltration, but relieved by carotid occlusion on the affected side, was not operated upon and continues to have his symptoms.

Of the seven patients with bilateral headache who were unrelieved by increased salt and calcium intake, in all but one the condition was greatly improved by the subcutaneous injection of 2 cc. of 1 : 2,000 solution of prostigmine methyl sulfate. In addition, dizziness was less marked, and four patients who had complained of nausea at the time of headache were relieved of this symptom. No untoward side reactions such as abdominal cramps, urinary frequency, or increased sweating were noted. The beneficial effects persisted during return to full duty for periods of from 2 to 7 days. Reinjection at the time of recurrence again resulted in complete relief. In one case it was

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necessary to give a second injection within 2 hours. Following this, one injection per week was sufficient. No prostigmine hydrobromide was available for oral administration.

Neither benzedrine sulfate (5 milligrams) three times daily nor ephedrine sulfate (45 milligrams) administered orally relieved the headaches. Dizziness improved but there was increased nervousness. The one patient who had been unrelieved by prostigmine, however, was definitely benefited by the use of oral ephedrine. This patient, it should be added, had pronounced postural hypotension and the lowest blood pressure of the entire group.

Ergotamine tartrate (0.5 milligram subcutaneously) caused severe exacerbation of headache in the three cases in which it was tried.

The following case report will serve to illustrate a typical tropical syndrome with severe incapacitating headache, the diagnostic procedures used, and the dramatic relief of symptoms under prostigmine therapy.

Case report.—A Marine private, first class, 22 years of age, had had tropical duty for 13 months, and at the time of admission to the hospital complained of intermittent severe headaches for 1 year, incapacitating for 2 weeks.

His history revealed a long-standing susceptibility to headache, worse with heat and exertion, less frequent and severe in a cold climate. His father and two sisters have similar headaches, also incapacitating at times. Since transfer overseas to a tropical climate, his headaches have grown increasingly severe and frequent until he became unable to perform his duties.

The headache was frontal, more pronounced on the left side. It usually occurred following exertion or exposure to heat, and built up to a climax. It was throbbing in character and was accompanied by dizziness, especially on assuming an erect position. During the climax of an attack he became nauseated, occasionally vomiting. There was no aura preceding an attack and no scotomata or sensory disturbances which might suggest migraine, but the patient had increasing difficulty in concentrating, with an accompanying mental depression. There was no history of trauma.

Examination revealed no ophthalmologic, neurologic, otorhinologic, or dental abnormality, and there were no pertinent findings on general physical examination. Careful psychiatric investigation uncovered no functional difficulties.

In addition to rest in bed, the patient received sodium chloride, 4 gm. three times a day, and calcium lactate, 0.66 gm. three times a day. Fluids were forced to 4,000 cc. daily. The headaches continued to occur during and following the hottest period of the day, at times necessitating the use of codeine, 0.1 gm. orally, with only partial relief. Oxygen inhalations failed to modify the headache.

Carotid occlusion relieved the pain on that side, but increased it on the opposite side. Jugular compression with a blood-pressure cuff about the neck relieved the headache and prevented the extreme dizziness which occurred when the patient abruptly stood. Occlusion of the temporal arteries or infiltration about them with procaine solution had no effect.

The blood pressure was 122/86 after 15 minutes' rest in the prone position. Immediately on standing the pressure fell to 68/60, returning to normal in 5 minutes.

Lumbar puncture in the sitting position during an attack of headache revealed a lowered intracranial pressure, the reading being 4 cm. below the level of the

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foramen magnum. Removal of 2 cc. of spinal fluid resulted in severe exacerbation of the headache, pronounced syncope, and peripheral vascular collapse. Intrathecal injection of 6 cc. of normal saline solution caused the headache to become much less severe and the syncope to be somewhat relieved. Headache again became severe upon lowering the pressure to its original level.

Following lumbar puncture the patient noticed no difference in the frequency or severity of his daily headache. He was given 1 cc. of 1:1,000 solution of epinephrine hydrochloride subcutaneously. His blood pressure failed to rise, and the headache was unaffected. The next day 0.15 gm. of ephedrine sulfate was administered subcutaneously. Again the blood pressure failed to rise appreciably, although he developed a rapid pulse, heaving apical impulse, decided increase in pilomotor reflex, sweating, and nervousness. He stated that his head felt "numb" but that the underlying headache seemed only slightly relieved.

On the following day the patient was given 0.5 milligram of ergotamine tartrate subcutaneously and the headache increased within 10 minutes. Following another injection of the same drug, within an hour of the first, the headache became excruciating and he felt nauseated.

During a subsequent severe attack the patient was placed in a walk-in refrigerator for 15 minutes with the temperature at 34° F. He stated that his headache began to improve within 5 minutes and at the end of the refrigeration period completely subsided. On return to the outside temperature the headache recurred. This procedure was repeated on several occasions, always with complete disappearance of his headache. He volunteered the statement that this was the first time any treatment had benefited him.

After 2 weeks of hospitalization and no lasting improvement, he was given 1 cc. of 1:2,000 solution prostigmine methyl sulfate subcutaneously. There was no variation in the pulse or blood pressure. Within an hour the headache and nausea were slightly improved. The injection was repeated and the headache and nausea disappeared in 30 minutes. No side reaction was noted. He was given a provocative test of strenuous exercise (jumping rope) in the midday sun. His headache did not recur, although previously such a test had resulted in severe pain and prostration. The headache did not return for 3 days despite normal activity about the ward and in the sun. He was given another injection of 1 cc. of 1:2,000 solution of prostigmine and returned to full duty which involved artillery practice in a field exposed to direct sunlight and high temperature. His headache remained completely absent for 1 week. Since then he has been given a similar dose of prostigmine about once every 10 days and has been symptom-free for the first time since entering the tropics. He has gained 15 pounds and states he has never felt as good since coming overseas.

COMMENT

Inasmuch as the above study was done in the field, certain supplies and equipment were not available for a complete physiologic investigation of the patients with this tropical syndrome. Certain tentative conclusions, however, may be drawn.

Two distinct types of organic headache occurring in the tropics have been described. The first is represented by the five cases with unilateral pain. Two of these had previous trauma to the area involved, one with a persistently sensitive scar. In all, the condition was relieved by selective arterial occlusion and made worse by heat and exertion and by a new provocative test of jugular compression. It is

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postulated that this type is caused by abnormal extracranial vasodilatation. The pain is conducted by afferent fibers coursing along the vessels and can be abolished by arterial and periarterial resection. These patients did not differ from the second type in their general vasomotor instability or sensitivity to heat and exertion. Their presenting symptom of unilateral pain, however, seemed to arise from a particular extracranial locus and did not respond to therapy consisting of increased salt and calcium intake or to prostigmine injections.

The second type is represented by the 15 cases of bilateral frontal headache. These headaches were all made worse by heat and exertion. Unlike the first type, they were often improved by the jugular compression test. Carotid occlusion seemed to relieve the headache on that side only, and often made the pain worse on the opposite side. Occlusion of extracranial arteries had no effect. From this evidence it would appear that the pain probably arose from intracranial vascular structures.

Since the headache was accompanied by decreased intracranial pressure in the upright position, made worse by lowering the level further, and absolished by raising the pressure, it could be assumed that traction on the intracranial vessels was a factor. By raising the intracranial pressure this traction was probably reduced. This type of headache is definitely aided by increased salt, calcium, and fluid intake, and by injections of prostigmine methyl sulfate. We are not prepared at this time to state the relationship of these agents to the factors of reduced intracranial pressure and altered vasomotor tone.

SUMMARY

1. A common tropical syndrome of headache and vasomotor instability has been described.

2. This organic headache may be divided into two types: Unilateral and bilateral.

3. The unilateral type is considered to be predominantly of extracranial vascular origin and can often be relieved by selective arterial resection.

4. The bilateral type is considered to be predominantly of intracranial vascular origin and can often be relieved by increased salt, calcium, and fluid intake, and by prostigmine methyl sulfate injections.

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HEADACHE: AN ETIOLOGIC APPROACH

WITH SPECIAL REFERENCE TO THE SO-CALLED "VACUUM HEADACHE"

H. LEONARD JONES, JR.
Commander (MC) U. S. N.

Headache is an important problem in the Navy, just as it is in civilian life. In the first place, it is a common complaint. Graybiel and his co-authors (*1*) reported an incidence of 677 cases (4.3 percent) in a series of 15,859 separate complaints among approximately 2,240 flying personnel at a Naval air training base, and make the plea that great consideration be given to minor illnesses because of their high frequency and consequent responsibility for loss of much flying time. Master (*2*), in reviewing the common medical conditions encountered in the South Pacific, cited headache as a common chief complaint, often due to sinusitis and eystrain as well as malaria and dysentery, but, in numerous cases, obscure in origin. In a study of 1,063 Naval offenders, Locke and others (*3*) found that repeated headaches were the stated cause of going AOL or AWOL in 20 of 265 cases, in which the reasons pertained to personal or family illness.

In the second place, the very fact that the term "headache" is used as a substitute for a definitive diagnosis in the Diagnostic Nomenclature for the Medical Department of the U. S. Navy is indicative of unsolved difficulties in etiologic diagnosis. The mere existence of such a term, without qualification as to etiology, must inevitably lead to complacency in some cases, and consequently to inadequate management. How often does the medical officer, pressed with a long line of ambulatory patients at sick call, prescribe symptomatic treatment for even the chronic headache? How often does he shrug his shoulders when the cause is not clear after a half dozen questions referable to the eyes, sinuses, etc.? How many patients with recurrent headaches of obscure organic or functional origin have been called "gold-brickers"? How many patients with headaches of allergic origin have been called neurotics? How many patients with "vacuum headaches," due to occluded sinus orifices, have been told, on the basis of negative clinical and x-ray findings, that their sinuses had nothing to do with their headaches?

So convinced has the author become of the complexity of this problem, and of the consequent need for a practical, though fairly comprehensive approach to it, that a method toward this end has been

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devised. Adapted especially for the ambulatory patient seen in the dispensary, it has obviated hospitalization for study of some obscure cases. It has also reduced the time, examinations, and tests to the minimum requirements consistent with a reasonably high degree of accuracy.

METHOD

The gist of the method is self-explanatory, as seen in the anamnestic questionnaire, and in the form for examinations, laboratory tests, roentgenograms and therapeutic tests which may be indicated in a given case.

This questionnaire history has justified itself for several reasons: (1) It saves a great deal of time, as the average time for its thoughtful completion is about 5 minutes, in contrast to 30 minutes for a conventional thorough history taken by the medical officer; (2) it serves as a convenient check-off list for questions which would otherwise often not be thought of, and which in themselves sometimes clinch the diagnosis or point the way to the most logical examinations and tests to be carried out first; (3) it serves as a record from which a detailed history can be composed for the individual's health record, if this becomes indicated; and (4) further data, occasionally required, can be elicited by the medical officer and recorded on the questionnaire, as he sees fit.

In the great majority of instances, a quick review of the completed questionnaire will suggest the proper confirmatory examination, either partial or complete, as well as the appropriate line of investigation with laboratory tests, x-rays, and therapeutic tests. Not infrequently the history will indicate two etiologic factors, such as a mild astigmatism and a low-grade chronic sinusitis or "vacuum headache" due to allergic rhinopathy or sinusopathy. The presence of other chronic complaints not referable to the head will, of course, suggest either a low-grade systemic organic disease, or a psychoneurosis, or both. Rarely the pattern of complaints will be so conflicting and bizarre as to raise a suspicion of malingering; this is in agreement with the reported low incidence of malingering among Navy draftees (*4*).

Manifestly, it would be impossible and far beyond the scope of this paper even to attempt an exhaustive etiologic classification of headaches. An excellent etiologic classification, in outline form, is presented in Chapter XIV of Nielsen's Textbook of Clinical Neurology (*5*). Nor is it the purpose of this paper to review the descriptions of and criteria for the diagnosis of various types of headaches. The following indicate a few available references, of which some, if not all, of the subject matter was used in formulating the above-described approach to this complex subject.

Headaches referable to scalp disorders (*5*) (*6*) and to skull changes

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QUESTIONNAIRE FOR ETIOLOGIC DIAGNOSIS OF HEADACHE

(Name) (Rank or rate) (Unit to which attached) (Date)

Age_____ Present Duties and Location_____
(e. g., machine shop, paint shop, flying TBFs, etc.)

INSTRUCTION: Since finding the cause of your headache depends *largely* on the history, answer the questions below THOUGHTFULLY and CAREFULLY. If you do not understand a question, consult the medical officer.

1. Is headache your only complaint? (Yes) (No)
2. If not, list your other complaints in the order of their importance and duration:
   (a) _____
   (b) _____
   (c) _____
3. Is headache your most important complaint? (Yes) (No)
4. Is headache usually located:
   (a) In front of head?
   (b) In back of head?
   (c) On sides of head?
   (d) On top of head?
   (e) Only on right or left side?
   (f) All over?
   (g) Band around head?
   (Cross out phrases NOT applicable.)
5. Does headache radiate or spread from:
   (a) Eyes (right) (left) (both)?
   (b) Ears (right) (left) (both)?
   (c) Temples (right) (left) (both)?
   (d) Cheeks (right) (left) (both)?
   (e) Jaws (right) (left) (both)?
   (f) Neck?
   (Cross out words NOT applicable.)
6. ONSET of headaches:_____
   (State month and year of first headache similar to one now complained of.)
7. FREQUENCY of headaches:_____
   (e. g., every 2 or 3 days, weekly, etc.)
8. DURATION of each headache is *usually:* _____
   (e. g., 1 hour, most of day, etc.)
9. TIME OF DAY headache *usually* occurs:
   (a) On arising in A. M.
   (b) About noon.
   (c) In P. M.
   (d) At bedtime.
   (e) Awakens from sleep.
   (f) Occurs at any time.
   (Cross out phrases NOT applicable.)
10. INTENSITY of headaches:
    (a) Severe.
    (b) Sharp.
    (c) Dull.
    (d) Boring.
    (e) Throbbing.
    (f) Incapacitating (inability to carry on with duties).
    (Cross out words NOT applicable.)
    Or does your head just "feel full?" (Yes) (No)
11. Do headaches appear and disappear:
    (a) Gradually? (b) Suddenly?
    (Cross out words NOT applicable.)
12. Do any of the following *repeatedly* bring on these headaches?
    (a) Physical exertion.
    (b) Changes in posture.
    (c) Your present work or duties.
    (e. g., noxious gas fumes, carbon monoxide, etc.)
    (d) Heat, with or without excessive sweating.
    (e) Excitement.
    (f) Nightmares.
    (g) Worry.
    (h) Frustration or disappointment.
    (i) Menstrual periods.
    (j) Alcoholic beverages.
    (k) Smoking.
    (l) Damp weather or moist climate.
    (m) Stuffiness of nose.
    (n) Swimming.
    (o) Eye strain (reading, attending movies, sun glare, etc.).
    (p) Particular type of food (e. g., milk, wheat, eggs, onions, legumes, nuts, beans, chocolate, fish, beef, pork, sea foods, etc.).
    (q) Flying or low pressure chamber run.
    (r) Combing hair or shaving.
    (s) Constipation.
    (t) Any other:_____
    (Check applicable phrases.)
13. Do any of the following conditions *repeatedly* develop just before or along with these headaches?
    (a) Spots before eyes.
    (b) Other impairment of vision.
    (e. g., double vision, partial blindness.)
    (c) A sense of well-being.
    (d) Nausea.
    (e) Vomiting.
    (f) Dizziness.
    (g) Ringing in ears (right) (left) (both).
    (h) Watering of eyes (right) (left) (both).
    (i) Burning of eyes (right) (left) (both).
    (j) Redness of eyes (right) (left) (both).
    (k) Running of nose.

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(l) Tender spot on scalp.
(m) Stiff neck.
(n) Toothache.
(o) Chills or fever.
(p) Fatigue.
(q) Aching all over.
(r) Name any other condition:____
_____
(Check applicable phrases.)

14. What medicine or other treatment have you taken for these headaches? _____
_____
_____
How often?_____
How effective?_____

15. What diagnoses have been made to account for your headaches?____
_____
_____

16. Have you ever worn glasses? (Yes) (No)
If so, when were they last checked?
Month_____ Year_____
Do you wear them constantly? (Yes) (No)

17. Do you often "hawk up" or cough up "phlegm" or mucus, especially in the morning? (Yes) (No)
(a) White. (d) Thick.
(b) Dark brown. (e) Sticky.
(c) Yellow. (f) Watery.
(Cross out words NOT applicable.)

18. Have you had inoculation (shots) within the past 7–10 days? (Yes) (No)

19. Have headaches ever disappeared following an operation? (Yes) (No)

20. Have you ever been near a—
(a) Bomb blast?
(b) Concentrated shellfire?
(c) Underwater blast (depth charge, torpedo, etc.)?
(Cross out phrases NOT applicable.)
If so, when and how often?_____
_____
_____

21. Have you ever had a head injury? (Yes) (No)
If so, when?_____
Did you lose consciousness? (Yes) (No)
Did you sustain a skull fracture? (Yes) (No)
Have you had difficulty concentrating since then? (Yes) (No)
Were you hospitalized? (Yes) (No)
How long?_____

22. Have you ever had any of the following?
(a) Frequent vomiting as a child.
(b) Asthma.
(c) Hives.
(d) Hay fever.
(e) Eczema.
(f) Nervousness.
(Cross out words NOT applicable.)

23. Have any members of your family had frequent or "sick" headaches? (Yes) (No)
Or any of the conditions listed in question 22? (Yes) (No)
If so, how many?_____
_____
_____
(e. g. mother, 2 brothers, aunt, etc., followed by condition.)

24. Additional information:_____
_____
_____
_____

EXAMINATIONS AND TESTS AVAILABLE FOR ETIOLOGIC DIAGNOSIS OF HEADACHE

I. (a) Temperature _____
(b) Pulse _____
(c) Respirations _____
(d) Blood pressure_____

II. HEAD—
(a) Scalp: _____
(Tender area, lesions, etc.)
(b) Lymph nodes: _____
(Suboccipital, post- and pre-auricular)

III. NECK: _____
(Stiffness, tenderness, anterior and posterior lymph nodes.)

IV. EYES—
(a) Inspection: _____
(Inflammation, congestion, epiphora, proptosis, EOM reaction, squint, etc.)
(b) Palpation: _____
(Tension for glaucoma)
(c) Auscultation: _____
(For pulsating aneurysm)
(d) Visual acuity: _____
(Obtain very best)
(e) Refraction (if indicated):
During cycloplegia:
OD _____
OS _____
Postcycloplegic acceptance:
OD _____
OS _____
(f) Ophthalmoscopic examination (if indicated):
(g) Phorometry (if indicated):
ESO:_____ EXO:_____
HYPERPHORIA: Rt____ Lt____
(h) Other tests (if indicated):
_____
_____

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V. EARS: _____
(Auricles, otoscopic examination, mastoid tenderness)

VI. NOSE: _____
(Congestion, inflammation, significant deviation of septum, discharge from sinus ostia, allergic appearance, polyps, spurs, etc.)

VII. SINUSES: _____
(Tenderness, transillumination)

VIII. MOUTH—

(a) Pharynx: _____
(Inflammation, postnasal discharge, etc.)

(b) Teeth: _____
(Caries, impaction, abscess, etc.)

(c) Tongue: _____
(Coating, atrophy, tremor, etc.)

IX. General examination (if indicated):

Positive findings: _____

X. Neuropsychiatric examination (if indicated):

Summary of pertinent findings: _____

XI. Impression: _____

A. Laboratory tests indicated:

(1) _____ _____
(Results)

(2) _____ _____
(Results)

(3) _____ _____
(Results)

(4) _____ _____
(Results)

B. Roentgenograms indicated:

(1) Skull:

a. AP and Lateral: _____
(Interpretation)

b. Special views: _____

(2) Sinuses: _____
(Interpretation)

(3) Mastoids: _____
(Interpretation)

(4) Teeth: _____
(Interpretation)

(5) Cervical spine:

a. AP and Lateral: _____
(Interpretation)

b. Special views: _____

C. Therapeutic tests (or tests of induction) indicated:

(1) Trial of eyeglasses (even for small refractive error, especially mild astigmatism): _____
(Effect on headache)

(2) Simple nasal vasoconstriction (spray or drops with patient in Beck's position): _____
(Effect on headache)

(3) Proetz displacement method: _____
(Effect on headache)

(4) Intranasal suction by means of oxygen mask (Gibb's procedure): _____
(Effect on headache)

(5) Low-pressure chamber runs: _____
(Effect on headache, ear pain or toothache with cephalic radiation)

(6) Change to different type of duty (to eliminate possible noxious gases, allergens, emotional stresses, etc.) _____
(Effect on headache)

(7) Change to dry climate: _____
(Effect on headache)

(8) Abstention from tobacco, alcohol, coffee, etc.: _____
(Effect on headache)

(9) Elimination diets:

a. Method of eliminating the allergic food suspected from history: _____
(Effect on headache)

b. Method of eliminating the common allergic foods one by one: _____
(Effect on headache)

c. Diet of lamb, rice, and pears: _____
(Effect on headache)

d. Fasting (if headache almost constant): _____
(Effect on headache)

(10) Skin tests (if indicated and available): _____
(Effect on headache)

(11) Ingestion of increased amounts of sodium chloride (as indicated from history of duty, tropical climate, etc.): _____
(Effect on headache)

(12) Ingestion of increased amounts of vitamin B complex or multiple vitamins: _____
(Effect on headache)

(13) Ergotamine tartrate (gynergen) 0.25 to 0.5 milligram subcutaneously early during attack, or in small doses, intravenously: _____
(Effect on headache)

(14) Prostigmine bromide orally: _____
(Effect on headache)

(15) Oxygen 100-percent by inhalation: _____
(Effect on headache)

(16) Epinephrine hydrochloride 1:400,000 solution intravenously:
(Effect on headache)

(17) Histamine 0.1 to 1.2 milligram subcutaneously: _____
(Effect on headache)

(18) Method of hyposensitization to histamine: _____
(Effect on headache)

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(19) Injection of 10 cc. of 1-percent procaine into tender area of scalp:

_____
(Effect on headache)

D. Specific treatment of underlying systemic disease believed responsible for headache:

_____ _____
(Treatment) (General effect)

_____
(Effect on headache)

E. Psychotherapy:

(1) _____
(Effect on headache)

(2) _____
(Effect on other complaints)

F. Symptomatic treatment of underlying systemic disease believed responsible for headache:

(1)_____ _____
(2)_____ _____
(3)_____ _____
(Treatment) (General effect)

_____
(Effect on headache)

G. Additional diagnostic procedures:

(1)_____ _____
(Effect)

(2)_____ _____
(Effect)

H. Etiologic diagnosis:_____
_____

(*5*) (*7*); those following brain injuries (*5*) (*8*) (*9*) (*10*) (*11*) and obscure traumatic lesions of the cervical spine (*12*) (*13*); those associated with eye diseases (*14*) (*15*) (*16*) (*17*) (*18*) (*19*); those referable to ear conditions (*17*) (*20*); headaches related to diseases of the nose and paranasal sinuses (*7*) (*20*) (*21*) (*22*) (*23*) (*24*); to the teeth (*25*); migraine, allergic, and histamine headaches (*26*) (*27*) (*28*) (*29*) (*30*); those due to hypoxia, accelerative changes, air sickness and noxious gases (*17*) (*31*); headaches accompanying heat disorders (*32*) (*33*) (*34*); those occurring in combat fatigue, psychoneuroses, etc. (*35*) (*36*) (*37*) (*38*); those apparently due to avitaminoses, especially that of B-complex (*39*); headaches in such diseases as hypertension and nephritis (*40*), blood dyscrasias, and in association with menstruation, menopause, and constipation (*41*); headaches due to drug intoxications (*41*) and to caffeine withdrawal (*42*).

It is well known that any febrile disease may be associated with headaches (*5*) (*41*). Perhaps it is not as well known that almost any abortive or atypical, afebrile or subclinical form of an infectious disease, or often an incipient stage of such a disease, may be characterized by headache as the chief complaint. In this connection, one must bear in mind such diseases as the frequent aberrant forms of the acute respiratory infections (*43*), (*44*) (*45*), epidemic dengue (*46*) (*47*) (*48*), and epidemic diarrhea, nausea, and vomiting (*49*), and the meningitides (*50*) (*51*) (*52*), as well as low-grade malaria and incipient cerebral malaria (*53*), filariasis (*54*), subclinical leptospirosis (*55*) and syphilis (*56*).

APPLICATION OF THE METHOD

The above-described forms were used for patients complaining chiefly of headache in whom the diagnosis was not immediately clear from other symptoms. The patients were seen during a 6-month period in a small dispensary which served an average of about 400 personnel. Special diagnostic procedures were carried out at a nearby fleet hospital. The following table shows etiologic diagnoses arrived at in 32 cases:

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Etiologic diagnosis of headache:	*Number of cases*
"Vacuum headache" due to rhinosinusopathy*	6
Error of refraction	5
Allergic rhinitis (associated with "vacuum headache")	4
Psychoneurosis	2
Posttraumatic syndrome	2
Malaria, benign tertian	1
Allergic headache	1
Migraine	1
Simple adult maladjustment	1
Headache due to cervical rib	1
Ciliary spasm	1
Exophoria	1
Sinusitis, chronic, frontal and left antral (Str. viridans?)	1
Occlusion of eustachian orifice	1
Heat exhaustion, recurrent (low-grade)	1
Total	29
Cases of headache due to two factors:	
"Vacuum headache" due to rhinosinusopathy (occipital)* + Error of refraction	1
Error of refraction + Neurasthenia	1
Chronic arthritis due to chronic prostatitis + Error of refraction	1
Total	3
Grand total	32
Causes undetermined, still under investigation	6

*Criteria for diagnosis:

(1) History of sinus-type headaches.

(2) Examination essentially negative, except for mucoid, nonpurulent postnasal discharge.

(3) Smear and culture of postnasal discharge showing no eosinophils and no bacteria not ordinarily present in nasopharyngeal flora.

(4) Roentgenograms of sinuses either negative or showing minimal changes only.

(5) Relief of headaches immediately following nasal vasoconstriction and/or intranasal suction.

Among the various types of headaches studied, there were three especially interesting cases of different etiology. These deserve a brief summary in this paper because they illustrate certain interesting features, not the least of which was the long duration of the headache in each case which went undiagnosed and therefore escaped specific treatment; i. e., cases 1 and 2. Case 3 is representative of a number of cases of the so-called "vacuum headache."

CASE REPORTS

Case 1.—A 44-year-old Naval officer had suffered for 24 years from headaches occurring every 2 or 3 days. The pain was located usually in the back of the head,

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but at times "all over," and was described as variable in character; sometimes just a feeling of fullness, but often a dull pain; at times boring or throbbing, aggravated to severe or sharp intensity by exertion, excitement or very small amounts of alcoholic beverages. These headaches appeared and disappeared gradually, and were often associated with a stiff neck and a tender area in the back of the head, as well as with distinct fatigability.

Acetylsalicylic controlled the milder headaches, but the frequency of the severe ones led to the following different treatments, none of which influenced the headaches: Nasal operation with removal of "bone structure"; extraction of two teeth; oxygen inhalations. However in 1941, nicotinic acid, in 25-mg. oral doses, definitely relieved an individual headache, but did not prevent recurrences. In 1943 the patient began duty in the South Pacific where the hot, humid climate seemed to cause an increase in the severity and frequency of his headaches, which became relatively refractory to acetylsalicylic and nicotinic acids. Search for an allergen revealed wheat and its products to be the sole cause of his headaches. Its elimination from his diet during a 3-month period has given him complete freedom from headaches and fatigue. On 3 occasions, at about 2-week intervals, the trial of a slice of bread produced a headache the following day.

As this patient has a brother, 40 years of age, who had suffered for over 20 years from attacks of severe headaches, the patient wrote him about his own relief, with the result that he, too, has now been free from his headaches for 2 months, the longest interval since their onset.

This case is somewhat similar to that reported by Randolph (*30*) in that efforts at diagnosis and treatment, including an operation, over a period of years proved fruitless until the specific allergen was discovered. It emphasizes again how important it may be to a patient's whole outlook on life to find an allergic basis for the headache, and how simple and thoroughly gratifying the treatment can be.

Case 2.—A 41-year-old Naval medical officer had suffered off and on since childhood from bilateral frontal and temporal headaches, associated with a visual field defect, scintillating scotomata and nausea. The headaches, which gradually increased in severity would last for as long as 3 days, occurring approximately biweekly. Excitement, frustration, and bright lights seemed to precipitate the attacks.

The following diagnostic procedures and treatment were carried out with negative results: Gallbladder series, gastric analyses, correction of refractive error, intravenous calcium gluconate, and a 30-day course of histamine desensitization injections.

In May 1944, ergotamine tartrate was tried for the first time with excellent effect, but the patient found that he had to use larger and more frequent doses to control the attacks, which became worse during sea duty. Signs of toxicity were soon reached and the drug was abandoned in favor of 100-percent oxygen inhalations. Even only 1 to 3 minutes of 100-percent oxygen aborted an attack, if the inhalations were started soon enough. This therapy, moreover, seemed to break up a vicious cycle of attacks which were increasing progressively in severity and to a frequency of every 5 or 6 days.

This case of migraine is interesting because, even though the patient was a highly trained doctor, the etiology of his headaches was not disclosed over a period of many years, despite the quite typical history. It is also remarkable for the decreasing beneficial effect of ergotamine

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tartrate, leading to toxic doses, and the subsequent amazingly effective use of oxygen inhalations.

Case 3.—A 34-year-old Naval officer had for about 10 years complained of periodic dull headaches, usually frontal, sometimes occipital, generally worse on awakening, but gradually disappearing after the raising of a thick, mucoid, brownish or white discharge. The "hawking up" of his postnasal discharge was often facilitated by a nasal spray with a vasoconstrictor solution. This patient almost always developed headaches of identical character whenever he made an airplane flight above 2,000 or 3,000 feet; these appeared usually on descent and persisted until a nasal spray and/or suction was used. Sometimes the simple maneuver of closing the nostrils and inhaling sharply to create negative pressure (suction) would rather suddenly eliminate the headaches. Proetz treatment, which yielded pure mucus without pus or eosinophils, dramatically eliminated one attack which was more severe than usual. Warm climate of high humidity, and excessive smoking definitely aggravated his headaches.

Examinations by otolaryngologists and three sets of sinus films during the preceding 5 or 6 years had failed to reveal evidence of a true sinusitis, or an allergic rhinopathy or sinusopathy.

This case is typical of a considerable number of patients with similar symptoms, but with nose, throat and sinuses essentially normal clinically and radiographically.

The author first became interested in these cases 2 years ago when he had duty in a low-pressure-chamber indoctrination unit. He was impressed with their prevalence, and with the fact that these mild symptoms were identical, whether occurring at sea level in the morning on arising, or during aerial flight. The low-grade intensity in many cases seemed to be the chief reason that they were overlooked or disregarded.

The production of the so-called "vacuum headache" by sinus orifice blockage from mucoid or nonpurulent, otherwise innocuous, nasal secretions, was firmly believed in by Sluder (*57*), who experimented with this condition. His theory would appear to be substantiated by the relief of these headaches in some patients by reducing the intranasal pressure. This is done frequently by the Proetz displacement method, by suction with the use of a gas or oxygen mask (*22*), and more recently in the low-pressure chamber (*23*). The author has used an oxygen mask (A14) successfully to alleviate some of these headaches, after the manner of Gibbs (*22*), with or without previous vasoconstriction, as follows:

1. Don mask, and adjust facepiece.
2. Suddenly and firmly close inlet tube and exhale to clear mask of any residual air.
3. Inhale as deeply as possible and hold breath for a few seconds (2 lbs. p. s. i. negative pressure is thus produced).
4. Repeat.

It seems reasonable to conclude that if this procedure relieves a headache immediately, the headache is due to a relative negative

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pressure (partial vacuum) exerting a cupping action on the mucosa of the sinus or sinuses, provided there is no purulent or irritating secretion therein. In such cases it may be speculated that during occlusion of the sinus orifice, the oxygen, constituting about 20 percent of the atmosphere in the sinus, has been absorbed, leaving a partial vacuum.

The nomenclature for these cases of headache is a problem (*21*), in the absence of a recognized cause of the sinus orifice block, such as acute vasomotor or allergic rhinitis (or rhinopathy), sinusitis (or sinusopathy), etc. But it would appear that "headache, vacuum, due to sinus orifice occlusion," or perhaps, "due to rhinosinusopathy" would be preferable to merely "headache," for the former would indicate at least part of the etiologic factors and the rational treatment.

SUMMARY

1. The importance of headache as a problem in the Navy is stressed.

2. For the purpose of facilitating the etiologic diagnosis of headache, a practical, methodical approach is presented, which employs a reasonably comprehensive anamnestic questionnaire, and a form for examinations, laboratory tests, roentgenograms, and therapeutic tests to be done as indicated.

3. This method has been used with gratifying results.

4. Reference is made to some of the numerous conditions which cause headaches.

5. Special emphasis is placed on the prevalence, diagnosis and treatment of the so-called "vacuum headache."

CONCLUSIONS AND RECOMMENDATIONS

1. The etiologic diagnosis of many headaches requires such a detailed history that it is ordinarily too time-consuming to be carried out thoroughly.

2. The application of the described method of attempting an etiologic diagnosis has simplified the solution to this complex problem, and has led to more rational therapy. It has also obviated the natural tendency to hospitalize some patients with headache of obscure origin, thus saving man-hours.

3. The Diagnostic Nomenclature for the Medical Department of the U. S. Navy lacks terms for certain headaches whose cause is partially, if not wholly known, such as "Headache, Vacuum Type," "Headache, Histamine Type," "Headache, Tension Type," etc. It is therefore recommended that the term "Headache #2131" be qualified with: "State type or cause, if known. Otherwise, add 'of unknown etiology'."

Since this article was submitted for publication, the revised "Statistical Reporting and Diagnostic Nomenclature, Medical Department, United States Navy," dated 1945, no longer carries the diagnosis "Headache, #2131." It would appear that such a diagnosis, if properly qualified, would be necessary.

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THERAPY OF GONORRHEA

There has as yet been no conclusive report concerning the possible development of asymptomatic carrier states following penicillin therapy. Nevertheless, at the present time and pending further investigation of such problems, aqueous solutions of penicillin given in three or more intramuscular injections over a period of approximately 4 hours, or oil-beeswax suspensions of penicillin given in single injections, seem to provide suitable therapy for gonorrhea. At least, the present unsatisfactory response to the sulfonamides justifies a change to penicillin even though it may not be the final solution to the problem of treating this disease.—Editorial: Penicillin in gonorrhea. Ven. Dis. Inform. 26: 93, May 1945.

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CAUSES OF UNIOCULAR AND BINOCULAR BLINDNESS IN THE U. S. NAVY AND U. S. MARINE CORPS IN WORLD WAR II

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World War II has been noted for the superb medical and surgical care of the injured fighting man. Eye injuries provide an interesting aspect of military medicine, although they comprise only a small percentage of the total injuries.

The eye injuries during the American Revolution of 1776 and the War of 1812 reveal nothing more serious than burns of the eyelids and eye from powder flash from old-fashioned flintlock muskets or from bits of flint itself. The Civil War was noted for the frequent occurrence of sympathetic ophthalmia. World War I was noted not only for severe eye injuries due to gunfire, but also ocular injuries due to poisonous gases. It is noteworthy that in World War I there was no case of sympathetic ophthalmia. World War II was characterized by better care of eye injuries, not so much because of improved surgical technics, but rather because of chemotherapeusis. The sulfa drugs and penicillin used soon after eye injuries have undoubtedly decreased the severity of eye complications.

Generally speaking, eye surgery in the military sphere differs from that in civilian life in that a wound of the eye is often virulently infected some days before surgical interference is possible. The tissues are also far more severely traumatized than in industrial accidents.

The surgeon has been taught to follow a plan of early and extensive debridement of gunshot wounds. However, such a course should not be followed in wounds of the eyelids in which primary suture is indicated. Infection following primary suture is extremely rare and when it does occur it can be easily controlled. Plastic work upon the eyelids varies from civil routine, in that marked defects of the orbital margins and bony structures of the face are encountered.

Many of the other ophthalmologic problems, such as iritis, corneal ulcers, and refractive errors, often cause more loss of manpower in combat than do the gunshot wounds of the eye. During a 1-year

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period, 10 times as many patients in one Naval base hospital were incapacitated and evacuated for refraction and diseases of the eye as those evacuated because of eye injury (*1*). The intra-ocular muscles can overcome a moderate hyperopia under normal conditions, but when persons with hyperopia are subjected to battle conditions, eye symptoms develop easily.

Frequently in war wounds the eye injuries may be more minor than wounds elsewhere and the major wounds must be cared for first. Injuries to the eyes must not be overlooked after these other major injuries are under control. There must be a close liaison between the ophthalmologist and the general surgeon. The eyeball sometimes appears literally to "explode" in the orbit. Often the orbital injuries from secondary bony missiles cause the eyeball more damage than the bullet itself. Bullets entering the eye anteriorly are rare.

Shell-fragment wounds around the eye often show incompletely burned powder incrusted in the face and eyelids; grains of sand, gravel, mud, and metal can give the extra-ocular region, cornea, and conjunctiva a tattooed appearance. These wounds must be irrigated with boric acid solution, the skin cleansed with soap and water, and each bit of embedded material must be painstakingly removed without causing too much reaction. Penicillin and sulfadiazine have greatly decreased the secondary infection resulting from these wounds.

Bomb explosions may produce such great air compression that retrobulbar hemorrhage with proptosis, total loss of vision, and subsequent optic atrophy develops. Iridodialysis and rupture of the choroid with secondary glaucoma may occur.

Thermal burns have been frequent in this war, although most of them have not resulted in blindness, either unilateral or bilateral. The eyelids have been principally involved. It is sometimes necessary to suture the eyelids together as an adjuvant to the general treatment.

An excellent description of eye casualties and diseases in combat was written by Benkwith (*2*). In some of his eye injuries he irrigated the anterior chamber with a freshly prepared solution of calcium penicillin, 10,000 units per cubic centimeter. Subconjunctival injections amounting to 2 cc. were made over the globe, using the above dilution of the commercial preparation of calcium penicillin.

In the statistics which follow we have defined blindness as a visual acuity of 20/200 or less, not correctible by any type of lens, or a permanent visual field of 15 degrees or less in its widest diameter. A total of 759 cases was studied.

BILATERAL BLINDNESS

During the World War II years up to and including the calendar year of 1944, there have been 119 cases of bilateral blindness in the

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United States Navy and the United States Marine Corps. The causes of binocular blindness may be subdivided into the following categories:

Trauma due to enemy action		72
Noncombat trauma (explosions etc., not in combat zone)		12
Blindness due to medical reasons		35
Chronic iritis	1	
Uveitis	2	
Chorioretinitis	2	
Retrobulbar neuritis	1	
Optic neuritis	1	
Optic atrophy (cause unknown)	8	
Methyl alcohol poisoning	19	
Optic atrophy secondary to brain tumor	1	

In the case of war wounds causing bilateral blindness, some of the injuries are almost freakish. One Marine was blinded by a bullet going through the left temple, removing both eyes and the bridge of the nose.

We were astounded by the number of men made blind by methyl alcohol. Methyl alcohol could be designated by some name which has no phonetic resemblance to ethyl alcohol, and the characteristic ethyl alcohol-like odor could be camouflaged.

UNILATERAL BLINDNESS

There were 640 cases of unilateral loss of vision in the United States Navy and United States Marine Corps. The causes of unilateral blindness may be divided into three main categories:

Trauma as a result of enemy action	322
Trauma as a result of noncombat action	143
Blinded because of medical reasons	126

These are classified as follows:

Cornea:		
Burns of the cornea	2	(2 enucleated)
Corneal opacity	10	
Malignant pterygium*	1	
Sclera: Malignant scleral nevus	1	(enucleated)
Iris: Iridocyclitis	5	(4 enucleated)
Lens:		
Traumatic cataract	12	(2 enucleated)
Senile cataract	1	
Choroid:		
Choroiditis	12	
Malignant melanoma	6	(all enucleated)
Posterior staphyloma	1	
Retina:		
Amblyopia ex anopsia	2	
Detachment of retina	5	

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Hole in macula	4	
Hypertensive retinopathy	1	
Thrombosis of central retinal artery	4	
Retinitis proliferans	1	
Retinitis pigmentosa	1	
Optic nerve:		
Coloboma of optic nerve	1	
Primary optic atrophy	4	
Secondary optic atrophy	15	
4 (skull fracture)		
4 (trauma)		
2 (meningitis)		
1 (measles)		
2 (optic neuritis)		
1 (pansinusitis)		
1 (retrobulbar neuritis)		
General:		
Endophthalmitis	2	(2 enucleated)
Primary glaucoma	3	(2 enucleated)
Secondary glaucoma	4	(3 enucleated)
Panophthalmitis	21	(21 enucleated)
Uveitis	3	(1 enucleated)

*Four operations were done to relieve this condition but a permanent opacity remained over the pupillary area of the cornea.

In a study of 901 nonfatal cases of heavier-than-air Naval aircraft accidents it was found that 40 patients had minor injuries to one eye and 15 had minor injuries to both eyes. Four had major eye injuries to one eye and one had major injuries to both eyes.

The 640 cases of uniocular blindness is unquestionably an understatement. For example there may be cases of primary atrophy due to syphilis in which the eye diagnosis is not mentioned, but the case itself may be listed under the diagnosis of dementia paralytica. Also there are many cases of diseases or injuries in which the vision was probably below 20/200, but the visual acuity was not recorded.

A particularly important subject in military ophthalmology is intra-ocular foreign bodies. Sixty-seven percent of the intra-ocular foreign bodies were classified as magnetic and 33 percent as nonmagnetic. About 50 percent of all cases of intra-ocular foreign bodies eventuated in enucleation. One nonmagnetic intra-ocular foreign body in the vitreous near the macula was removed by forceps under ophthalmoscopic visualization.

Frequently in war wounds the injury is so extensive that the eye cannot be saved, even though the intra-ocular foreign body is removed. Since the equipment necessary for the removal of an intra-ocular foreign body is large and cumbersome, resort to evacuation to a base hospital is often necessary and valuable time is lost. However these bodies have been removed successfully with the diagnostic

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aids of a portable x-ray machine and a sutured silver wire around the limbus as a locator.

Frequently a patient has so many wounds that the eye treatment must be postponed until shock and extensive bodily lacerations are treated. The history of the type of eye injury sustained by the patient is most important. Any evidence of a perforating injury to the eyeball should make one suspect an intra-ocular foreign body. A small conjunctival laceration with a subconjunctival hemorrhage may be the point of entrance of an intra-ocular foreign body. In the presence of a bloody vitreous, the possibility of an intra-ocular foreign body may be forgotten. A careful examination, under good visualization with the loupe, slit lamp, and ophthalmoscope, is the first step in the examination. A slit-lamp ophthalmoscope offers a valuable aid in penetrating cloudy vitreous. The point of entrance of an intra-ocular foreign body offers no definite clue as to its location. The ocular tension must be taken if there is any question of hypotony. The transilluminator can frequently demonstrate holes in the iris.

Roentgenography offers the best diagnostic aid for the presence and localization of an intra-ocular foreign body. A film taken in one or two positions may not rule out an intra-ocular foreign body. One must often resort to Vogt's "skeleton-free or bone-free" method for those foreign bodies in the anterior part of the eyeball. By the retrobulbar injection of 2 or 4 cc. of saline solution or procaine hydrochloride, an artificial proptosis is produced which frequently aids in roentgenographic diagnosis.

For successful removal of an intra-ocular foreign body, accurate localization is most important. Some of the obstacles to accurate localization have been described by Spackman (*3*). The roentgenologist and the ophthalmologist must thoroughly understand each other's problem. For magnetic intra-ocular foreign bodies the Berman locator (*4*) offers tremendous help, and because of its portability it can be used in places where an x-ray machine is not available.

The question of a "double perforation" of the eyeball can frequently be answered by injecting air into Tenon's capsule to produce proptosis, thus creating an area surrounding the eyeball of different density to the x-rays (*5*).

Localization of the intra-ocular foreign body can be accomplished by the modified Sweet method (*3*) or by the Comberg (*6*) contact lens. Thorpe (*7*) has devised a plastic contact lens by having suture holes drilled in it so that the lens can be sutured to the episcleral tissue. Frequently stereoscopic films are necessary.

In the operating room the ophthalmologist must determine whether the intra-ocular foreign body is magnetic or nonmagnetic. Thorpe has pointed out that the magnet should not be used for this purpose

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because there is a possibility that the intra-ocular foreign body might be pulled into tissues which would interfere with its removal. The Berman locator readily differentiates a magnetic from a nonmagnetic intra-ocular foreign body.

If the anterior segment of the eyeball is intact and the foreign body is in the vitreous, it should be removed by posterior sclerotomy. It is obvious that removal by the anterior route would result in damage to the lens, suspensory ligament, and ciliary body in such cases. The posterior route, as a rule, is preferable as offering the minimum risk except for those small foreign bodies not lying against the ciliary body.

When x-ray localization is impossible, tiny foreign bodies may be removed by the anterior route without material damage. Intra-ocular foreign bodies as large as 4 millimeters in diameter can usually be removed without enucleation, leaving a fairly good looking although sightless eye. Intra-ocular foreign bodies of from 0.5 to 2 millimeters in size generally leave a useful eye after their removal. It is imperative that diathermy punctures be made prior to the scleral incision when the posterior route is chosen. Foreign bodies in the anterior chamber and iris should be removed through a keratome incision at the limbus. Donovan (*8*) uses a spinal puncture needle with a syringe for suction to remove a small foreign body located in a traumatic cataract.

Spaeth has emphasized that the giant magnet has a diffuse magnetic field which can be varied, while the hand magnet has its only indication in cases where the tip can be applied directly or approximated to the foreign body at an interval no greater than 2 millimeters. In work with magnetic apparatus it is a refinement to have nonmagnetic instruments.

Nonmagnetic intra-ocular foreign bodies in the vitreous offer greater difficulty in removal. If the vitreous is clear, the Thorpe ophthalmic endoscope may be used, or the biplane fluoroscope method (*9*) (*10*) (*11*). The Thorpe endoscope was of no value in two cases; the instrument and the sclerectomy opening were too large. If the vitreous is cloudy, the biplane fluoroscope only may be used. Special grasping instruments have been devised by Thorpe and Cross.

Nonmagnetic foreign bodies anterior to the vitreous can be removed by forceps through a corneal incision. If embedded in the iris, an associated iridectomy is done. Those in the lens can be removed if and when the cataractous lens is extracted.

The concensus now is that nonmagnetic intra-ocular foreign bodies should be left in situ if they are not easily accessible. The question is wholly one of sympathetic ophthalmia. A sterile, chemically inert foreign body is usually harmless and becomes encysted. A wound involving incarceration of the ciliary body is dangerous.

The biplane fluoroscope is a large cumbersome instrument which is

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not generally available throughout the country. Borley and Leef (*12*) have extracted a nonmagnetic intra-ocular foreign body by using an ordinary x-ray machine for the vertical roentgenographs and a portable machine for the horizontal ones. This method should extend the use of the biplane fluoroscope. Too many eyes are lost because of the failure to attempt removal of nonmagnetic intra-ocular foreign bodies.

No case of blindness from sympathetic ophthalmia was recorded from the American Expeditionary Forces in 1917–18. Greenwood (*13*) accounted for this in three ways:

1. All eyes so badly injured anteriorly that a useful eye could not be expected were enucleated.

2. Less devastating anterior injuries were treated antiseptically, and often the wounds were sealed by a conjunctival flap, with the result that healing took place without subsequent iridocyclitis.

3. Enucleation was done in all cases of persistent iridocyclitis. The reason for the lowered incidence of sympathetic ophthalmia in military life is that patients in civil life are apt not to allow enucleation of an eye which, by reason of traumatic iridocyclitis, endangers the fellow eye, while in military life such eyes are removed at once.

In the Navy in World War II, five cases of sympathetic ophthalmia have been diagnosed following injury by intra-ocular foreign bodies. Penicillin was used in two of these cases without avail. The injured (sympathogenic) eye was removed in all cases, and useful vision was preserved in the sympathetic eye.

In World War I, of 48,290 patients with war injuries admitted to a casualty station, 1.54 percent suffered from injuries to the eye. Of these 0.8 percent were classified as serious. In the calendar year 1941, there were 16,730 patients admitted into Naval hospitals for eye conditions; 2.75 percent of these were traumatic injuries to the eye. In the calendar year 1942, 39,707 patients were admitted and 2.38 percent were for traumatic injuries to the eye. It may be seen, therefore, that almost 1 percent more eye injuries were encountered in World War II than in World War I.

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INACTIVATION OF PENICILLIN BY VARIOUS GRAM-NEGATIVE BACTERIA

The gram-negative bacteria commonly found in infected wounds, burns, or deeper abscesses are Escherichia coli, Bacillus pyocyaneus, Aerobacter aerogenes, Bacillus proteus, and Bacillus alkaligenes faecalis. Representative strains of each of these bacteria were obtained from infected wounds and cultured in broth by W. A. Altemeier of Cincinnati, to test their reaction to penicillin, with the following findings:

1. Various gram-negative bacilli commonly found in infected wounds were very resistant to the action of penicillin in concentrations up to 20 units per cubic centimeter. Higher concentrations up to 2,000 to 5,000 units per cubic centimeter produced a definite inhibitory effect on their rate and amount of growth. This effect was bacteriostatic in nature.

2. Bacillus alkaligenes faecalis, however, was found to be very sensitive to penicillin.

3. The activity of penicillin was progressively destroyed by the growth of these bacteria, particularly the Escherichia coli and Bacillus pyocyaneus in 4, 8, and 12 hours. The rate of destruction was greatest during the 8- to 12-hour period.

4. The degree of inactivation varied not only with the different types of bacteria but also with different strains of the same type.

5. The mechanical removal of devitalized tissue and purulent exudate followed by the topical application of higher concentrations of penicillin up to 1,000 or 2,000 units per cubic centimeter, at frequent intervals of 8 hours or less, is suggested in the local therapy of infected wounds to minimize the gram-negative bacterial inactivation of penicillin.—ALTEMEIER, W. A.: Inactivation of penicillin by various gram-negative bacteria. Surg., Gynec. & Obst. 81: 379–383, October 1945.

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SHIGELLOSIS STUDIES

I. ETIOLOGY AND CLINICAL FEATURES

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Bacteriologic and serologic studies in recent years have resulted in reclassification of the dysentery bacilli. The major groups of these bacteria produce disease syndromes which, in their classic forms, have some differentiating characteristics. The ability to suspect the causative agent from the clinical features of the syndrome is important because specific treatment differs somewhat for infections with each of the three major groups of shigella. Bacteriologic diagnosis is important for confirmation of the initial clinical impression, and after the outbreak is over, for the control of residual carriers. The etiology, diagnosis, prevention, and treatment of shigellosis have under combat conditions constituted an important problem in Naval medicine. Vigilance will continue to be necessary as long as large detachments of Naval personnel are stationed on foreign shores.

ETIOLOGY

The shigellas are the causative agents of bacillary dysentery. They are also responsible for some atypical diarrheas, pseudo-appendicular abdominal pains, and asymptomatic carrier states. These bacteria are nonmotile, gram-negative rods, which ferment glucose with the formation of acid without gas, and ferment lactose only slowly, if at all. They include the organisms formerly designated as belonging to the dysentery and paradysentery groups. They have been reclassified on the basis of their ability to ferment mannitol and lactose (table 1).

Group I (the Shiga group) ferments neither mannitol nor lactose. It includes the Shigella dysenteriae (Shiga bacillus) which is the only organism of the entire genus with a potent soluble exotoxin. Highly virulent, this bacillus usually produces violent dysentery and is only rarely obtained from carriers. Also in this nonmannitol-fermenting group are the S. ambigua (Schmidt's bacillus), and a biochemically

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atypical variant of S. flexneri VI, discussed below. All the members of this group are pathogenic.

Group II (the Flexner-Boyd group, ferments mannitol but not lactose. It includes the five Flexner strains originally classified according to antigens produced as V, W, X, Y, and Z by Andrewes and Inman (*1*) as well as nine additional strains isolated by Boyd (*2*), principally in India, and classified by him according to antigens produced. Some of these strains are nonpathogenic, as is Shigella alkalescens, included because of its morphologic and biochemic properties.

TABLE 1.—*Genus shigella*

[Gram-negative rods; non-motile; do not produce H_2S; do not utilize citrate; do not liquefy gelatin; Voges-Proskauer negative; salicin negative. All species except two subvarieties of S. flexneri VI ferment glucose with the production of acid without gas]

Group	Species	Previous designation	Glucose	Mannitol	Lactose	Pathogenic
"Shiga"	S. dysenteriae	Shiga bacillus	A	—	—	Yes.
	S. ambigua	Schmitz bacillus	A	—	—	Yes.
	S. flexneri VI	Newcastle bacillus	AG	—	—	Yes.
"Flexner-Boyd"	S. flexneri I	S. paradysenteriae V	A	A	—	Yes.
	S. flexneri II	S. paradysenteriae W	A	A	—	Yes.
	S. flexneri III	S. paradysenteriae Z	A	A	—	Yes.
	S. flexneri IV	Boyd type 103	A	A	—	Yes.
	S. flexneri V	Boyd type P 119	A	A	—	Yes.
	S. flexneri VI	Boyd type 88	A	A	—	Yes.
	S. flexneri VI	Manchester bacillus	AG	AG	—	Yes.
	S. flexneri VII	S. paradysenteriae X	A	A	—	Yes.[1]
	S. flexneri VIII	S. paradysenteriae Y	A	A	—	Yes.[2]
	S. flexneri IX	Boyd type 170	A	A	—	Yes.
	S. flexneri X	Boyd type P 288	A	A	—	Yes.
	S. flexneri XI	Boyd type D 1	A	A	—	Yes.
	S. flexneri XII	Boyd type D 19	A	A	—	Doubtful.
	S. flexneri XIII	Boyd type P 143	A	A	—	Doubtful.
	S. flexneri XIV	Boyd type P 274	A	A	—	Doubtful.
	S. alkalescens	S. alkalescens	A	A	—	No.
"Sonne-dispar"	S. sonnei	Sonne bacillus	A	A	[3] A	Yes.
	S. ceylonensis	S. dispar	A	A	A	Doubtful.
	S. madampensis	S. dispar	A	A	A	Doubtful.

[1] Probably a variant of S. flexneri III (Andrews and Inman's Z).
[2] Probably a variant of S. flexneri IV (Boyd type 103).
[3] Ferments lactose only after 48 hours or longer.
A. Fermentation reaction produces acid.
AG. Fermentation reaction produces acid and gas.
— No reaction.

Group III (the Sonne-dispar group) ferments mannitol with the formation of acid and inconsistently ferments lactose. The S. sonnei ferments lactose only after 48 hours or more, so that on initial differential lactose media it gives colorless colonies like those of other pathogenic strains. It is definitely pathogenic for children. The S. ceylonensis and madampensis (dispar strains) rapidly ferment lactose, and for this reason have been considered by some as not belonging to the shigella genus. Their pathogenicity is in doubt.

EPIDEMIOLOGY

The relative incidence of strains of shigella in different geographic localities varies considerably. Of 7,339 positive cultures in India

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between 1932 and 1935, Boyd found S. dysenteriae in 14.3 percent; S. ambigua in 5.5 percent; S. flexneri I, II, III, VII, VIII (former V. W, Z, X, and Y strains respectively) in 50.2 percent; S. flexneri IV. V. VI, IX, X, XI, XII, XIII, XIV (Boyd strains) in 15.3 percent; S. sonnei in 10.9 percent, and inagglutinable or unstudied organisms in 0.5 percent. Shigellosis is of worldwide distribution. Although present knowledge of the geographic distribution of the various strains of shigella is of little statistical significance, some of the organisms tend to predominate in certain localities (*3*).

S. dysenteriae is found with relatively high frequency in the Orient, but it also occurs in other parts of the world and has been cultured from outbreaks of dysentery in New York, California, Missouri, Michigan, and Kentucky as well as in Scotland, Germany, Egypt, the Philippines, India and some of the South Pacific Islands from Raboul to the Fijis. S. ambigua was first described in Rumania and has since been cultured in Germany, Scotland, the United States, the Philippine Islands, India, Uruguay, and Egypt. The S. flexneri has an extremely wide range of occurrence. Types I, II, and III are frequently encountered in nearly all parts of the world. Types IV and V were originally found in India but have been isolated in the United States.

Type VI has three biochemically different strains, all of which are quite common. The Newcastle variety, of which the Manchester strain is thought to be a cultural variant, has been responsible for numerous outbreaks in the United States, whereas the Boyd 88 strain has had a relatively high incidence in India and Uruguay. Types VII, VIII, and S. alkalescens have been reported throughout the world. The remaining strains of S. flexneri are less common and some of these are of questionable pathogenicity. Locations in which they have been cultured are reported by Weil (*4*). S. sonnei, one of the most widely disseminated shigellas, is present in all geographic regions. Little information is available with regard to S. ceylonensis and madampensis (or dispar group) which are probably largely nonpathogenic.

Ordinarily shigellosis is a disease limited to man, although spontaneous infections may occur in monkeys and have on rare occasions been observed in dogs, canaries, chickens, and foals. The infection enters the body through the ingestion of food contaminated by the feces of dysenteric patients or healthy carriers. According to Neter (*5*) 3 percent of convalescent carriers may excrete the organisms 3 months after onset of the disease. A small percentage of persons excrete the organism for a year following symptoms, and there are some carriers with no clinical history at all. Carriers of S. flexneri are often asymptomatic, whereas those harboring S. dysenteriae (the

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Shiga bacillus) usually have persistent symptoms. In fact they are usually too ill to be ambulatory and seldom go unsuspected. The carrier rate in New York city for all dysentery organisms is less than 1 percent. The carrier rate in New Mexico is 11 percent, and in Puerto Rico and Panama it is about 5 percent (*6*). The incidence of the carrier state varies with the seasons and is greatly increased by warm temperatures. Dysentery of the shigella type has a tendency to creep in where harsh climatic conditions and diseases such as malaria have a tendency to cause disability.

Flies are the common vectors of fecal contamination. Manson-Bahr has demonstrated that flies may actually harbor the shigella in their intestinal tracts. Prevention of the spread of shigellosis is dependent upon the adequate treatment of sewage, control of carriers, and elimination of insect vectors, principally flies.

SYMPTOMS

The incubation period of bacillary dysentery varies from 1 to 7 days, the average being from 3 to 5 days. The classic onset consists of chills, fever, headaches, prostration, nausea, vomiting, and diarrhea. Tenesmus is present and the stools rapidly assume a characteristic appearance. The patient is "glued to the bedpan." Vesical tenesmus may also be present and the urine small in amount. The temperature rises to from 101° to 104° F., with slight evening elevations and no intermission for the first 5 to 10 days. In uncomplicated cases the disappearance of fever is not followed by any secondary temperature rise. The lower part of the abdomen is tender throughout, but tenderness and muscle spasm are maximal along the descending colon. The rapid loss of fluid and base from the bowel leads to dehydration and emaciation (*7*) (*8*).

In temperate climates, and especially in cases in which the Flexner organism is present, the symptoms may be mild. There may be variations in the clinical picture from asymptomatic carrier states to more severe types of dysentery. In a characteristic Flexner infection there

TABLE 2.—*Symptoms in 473 proved cases of paradysentery infection**

	Milder cases (percentage)	Severe cases (percentage)		Milder cases (percentage)	Severe cases (percentage)
Diarrhea	100	100	Irritability	52	66
Blood in stools	38	64	Weakness	61	84
Abdominal pain	69	82	Convulsions	1	11
Mucus in stools	82	91	Fever	63	85
Straining (tenesmus)	48	63	Dehydration	9	33
Anorexia	61	77	Loss of weight	35	71
Vomiting	33	61			

*From: HARDY, A. V. and WATT, J.: Studies of acute diarrheal diseases; clinical observations. Pub Health Rep. **60**: 521-531, 1945.

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may be a gradual onset of colicky pains, anorexia and nausea, watery diarrhea, and mild tenesmus. Fever may be slight or absent, and constitutional reaction may be moderate.

An extensive survey of symptoms in 473 cases of diarrhea caused by paradysentery organisms is summarized in table 2. The cases were arbitrarily divided into two groups, on the basis of severity.

The over-all mortality in these cases was 8 percent (17 percent of the severe cases) with all of the deaths occurring in children under 2 years. Fifty percent of the patients recovered at the end of 10 days, but a small percentage still had symptoms or carried pathogenic bacteria at the end of 4 weeks (*9*).

In almost 80 percent of infections due to S. dysenteriae and S. ambigua the symptoms are classic. The onset is sudden and severe, with prostration, high fever, and overwhelming signs of toxicity. The diarrhea is marked, and the stools may average from 20 to 40 small evacuations a day. The exotoxin of S. dysenteriae is responsible for the variety of reactions seen in this type of infection. The temperature may be subnormal, and evidence of peripheral vascular collapse may be present. The abdomen may be soft, flaccid and scaphoid, and fail to show characteristic tenderness or muscle spasm. Other effects of the exotoxin are arthritis, paralytic ileus with paradoxical obstipation, and a syndrome resulting from toxic degeneration of anterior horn cells in the spinal cord resembling anterior poliomyelitis (*7*).

Infections with S. sonnei also give rise to a variable clinical picture. Most often this organism causes a milder disease with slight or transient fever. The abdominal symptoms may be preceded by respiratory catarrh. In children, however, this organism may produce a very severe form of the disease, resembling the most severe Flexner infections (*9*).

The eventual course in patients with chronic bacillary dysentery infections is not clear. Some remain carriers without symptoms. Others continue to have diarrhea with blood, mucus and pus; watery diarrhea without gross blood; rectal bleeding without diarrhea; or miscellaneous and anomalous digestive symptoms. Felsen and his collaborators have advanced the hypothesis that distal ileitis and ulcerative colitis are specific forms of chronic bacillary dysentery. Their data is based on the end results of an outbreak of bacillary dysentery, on the isolation of the shigella and on agglutination titers (*10*). Stitt recognizes a form of chronic bacillary dysentery with continuance of symptoms and with detectable bowel wall changes. The differentiation of this condition from idiopathic granulomata is difficult as bacteriologic substantiation is often missing. In the absence of positive culture, the only criterion would appear to be the antecedent history of dysentery.

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To summarize: Shigella infections may vary from asymptomatic carrier states to severe choleriform dysenteries which may result in death within a few hours. Between these extremes are the mild and severe forms of Flexner infection commonly seen in the temperate zone; the more severe form of Shiga infection that occurs epidemically in the temperate zones and endemically in the tropics; and the widely distributed Sonne infections, characteristically mild, but which in children may assume the character of severe Flexner dysentery.

STOOLS

In the first stage of acute bacillary dysentery the stools are frequent and consist of brown fecal material. It is characteristic of this type of dysentery that the evacuations are small and not offensive to smell, although they may have a musty odor. Later there are numerous watery evacuations, from 6 to 30 a day, which rapidly lose their feculent character. Small shreds of viscid mucus are passed. These are blood streaked. From this mucus the shigella organisms can usually be cultured early in the disease (*2*).

Later the mucus may be bathed in blood, but this is not an admixture as the blood can usually be washed off, leaving the mucus itself unstained. The mucus becomes glistening and takes on a whitish-yellow color. Later the stools become more purulent. The mucus becomes more viscid and resembles red currant jelly. In severe cases blood clots may be present in a mixture of green bile-stained mucus and pus. Large amounts of dark and decomposed blood and necrotic membrane passed in the most acute and fulminating cases have been compared to "meat washings" (*11*).

As recovery sets in, the stools become less frequent. The blood and mucus disappear first, then the pus, which is the last sign of exudation. Finally the stools become more feculent, and depending upon the severity of the dysentery and the presence or absence of residua, they become normal in the second to fourth week.

The feces of all symptom-producing shigella infections contain a characteristic cellular exudate, which is visible on microscopic examination. After the feculent character of the stools is lost, there remain strands of mucus and many polymorphonuclear cells (90 per-cent). Large macrophages are characteristic of bacillary dysentery. These often contain remnants of other cells and may be confused with amebas. The polymorphonuclear cells may show evidence of degeneration from the toxic action of the shigella organism. Such affected cells are called "ghost cells," and their presence is typical of shigellosis. Red blood corpuscles and desquamated epithelial cells are seen. With the progression of ulceration and extension of the process to new areas there is a marked increase in young leukocytes and macrophages.

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With healing there is a decrease in these elements; the macrophages are the first to disappear. Later the relative percentage of lymphocytes increases. The final picture consists of a few strands of mucus containing leukocyte remnants and epithelial debris. With healing the mucus becomes drier and more viscid. Recovery is marked by normally formed stools and the absence of all exudation (*11*).

SIGMOIDOSCOPIC EXAMINATION

Sigmoidoscopic examination is ordinarily not necessary for the diagnosis of early, acute bacillary dysentery. When performed in typical cases, however, the mucosa shows a diffuse hyperemia and superficial edema. The walls are bathed in mucus and serosanguineous material. Later clumps of pus are seen, and the blood elements are clotted. The bowel wall shows increasing edema and appears much thickened. Soon pinhead-size red elevations are noted. These occur in areas of lymphoid hyperplasia which soon show small yellow points at their summits and later break down, leaving small, acute, bleeding ulcers. These tiny lesions are contrasted against a background of diffusely hyperemic and edematous bowel wall with no signs of uninvolved tissue. As the disease progresses, the ulcers enlarge and become more prominent. They tend to coalesce but do not extensively undermine the mucosa or have overhanging edges like those seen in amebic dysentery (*7*) (*8*).

In severe cases, a necrotic, pseudodiphtheritic membrane forms which sloughs off and leaves a bleeding ulcerated surface with fresh granulations. This process may be so extensive as to leave only small islands of inflamed but viable tissue.

DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS

Shigellosis must be suspected in any patient with diarrhea and abdominal cramps not obviously explained by another illness. The likelihood of this disease is increased in the presence of rigors, prostration, fever, tenesmus, and characteristic stools. Further examination of the stool, if positive for cellular exudate, supports the diagnosis.

Bacillary dysentery infections may exist without typical symptoms, so that the principal basis for diagnosis is the culture of the organism (*12*). The fresh plating of Shigella-Salmonella agar with mucus or other material obtained by the rectal swab technic yields a much higher percentage of positive cultures than former methods (*13*). The obtaining of positive cultures is enhanced by an early

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examination of the exudate with as little fecal admixture as possible (*2*).

Colorless colonies on S-S agar are suspected and are transplanted to a Russell double sugar slant which serves for further differentiation and as a stock culture. The chemical reactions are then studied on special sugar media. Finally typing sera are available for differentiating types of shigellas by their antigenic structures (*12*).

Agglutination of a known strain of Shigella dysenteriae (Shiga bacillus) by a 1:40 or above dilution of the patient's serum is diagnostic of present or previous infection by that organism. Agglutinations of the Flexner strains are of little value, as normal persons may have antibodies against the group antigen present in these bacilli (*2*).

Bacillary dysentery in its clinical aspects may resemble streptococcal, staphylococcal, or salmonella food infection (*5*). All of these have a shorter incubation period and are likely to be associated with more vomiting. The characteristic stool exudate is lacking. Heavy metal poisoning, diverticulitis, regional enteritis, and neoplasms of the colon can assume dysenteric forms. Ulcerative colitis, which for lack of better evidence is called idiopathic, has strong resemblances. Less common colitides, such as cecal tuberculosis, balantidiasis, schistosomiasis and lymphopathia venereum must also be ruled out.

Amebic dysentery is most easily confused with the bacillary type. Although multiple criteria have been quoted for this differential diagnosis, in our experience the most valid are those shown in table 3.

Bacillary dysentery usually assumes a clinical pattern similar to one of those described above. The clinical features of amebic dysentery may, however, be protean, and in some cases mimic those of any form of bacillary dysentery. In acute cases of dysentery, which appear clinically to be shigellosis but in which the diagnosis cannot be definitely established and there is a clinical suspicion of amebic dysentery, a therapeutic trial of emetine is indicated. This may avert such complications as perforation of the bowel and hepatitis, which occur in amebic infections.

TREATMENT

1. *Chemotherapy.*—Sulfonamides are the most effective drugs used at the present time in the treatment of bacillary dysentery. For routine purposes the readily absorbed sulfonamides (sulfadiazine, sulfathiazole, sulfapyridine) are preferable to the poorly absorbed ones such as sulfasuxidine and sulfaguanidine. The latter do not effectively reach dysentery bacilli within the mucosa of the bowel. They have

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TABLE 3.—*Differential diagnosis*

	Bacillary dysentery	Amebic dysentery
Onset	Acute	Usually insidious.
Spread	Epidemic common	Endemic and isolated.
Type	"Lying down dysentery"	"Walking dysentery."
Pyrexia	Common	Uncommon or without complications.
Signs	Generalized tenderness over abdomen, with increased tenderness over descending colon.	Local tenderness over descending colon, with soft abdomen.
Tenesmus	Usually severe	Slight if present.
Chronicity	Not common	Common.
Stools	Small, frequent, not offensive. Bright red blood and mucus, not mixed with feces.	Copious, offensive stools. Feces intermingled with blood and mucus.
Microscopic stool	Numerous pus cells, red cells, macrophages and "ghost cells."	Numerous red cells but few pus cells. Nuclear fragments of pus cells seen. Motile ameba with ingested red cells. Charcot-Leyden crystals are common.
Sigmoidoscopic	Acutely edematous, hyperemic and rigid, spastic bowel wall. Ulcers may not show, due to excessive exudate. Ulcers on background of diffuse mucosal inflammation.	Usually mucous membrane is lax and redundant, with discrete, undermined ulcerations. Unless secondary infection is present, the intervening mucosa may not be involved.

their place, however, in resistant infections which have failed to respond to routine therapy. Infections with S. sonnei are particularly likely to fall in this group (*15*). The drugs of choice in the order of effectiveness and the recommended dosages are as follows:

Sulfadiazine, 1.0 gm. (15 grains) every 6 hours.
Sulfathiazole, 1.0 gm. (15 grains) every 6 hours.
Sulfapyridine, 1.0 gm. (15 grains) every 6 hours.
Sulfasuxidine, 5.0 gm. (75 grains) every 6 hours.
Sulfaguanidine, 3.5 gm. (53 grains) every 6 hours (*16*).

The sulfonamide is given until the following conditions are met:

1. All symptoms subside.
2. At least two stool cultures are negative.
3. There is no longer any inflammatory exudate in the stool.

In patients with persistent symptoms, sigmoidoscopic and x-ray examinations of the colon should be made. If these studies are negative, there is little probability of subsequent chronic dysentery.

During administration of a sulfonamide, the urinary output must be maintained in excess of 1,500 cc. daily and alkaline in reaction. Because of the tendency to dehydration and acidosis in all fulminating diarrheas, it is often necessary to employ intravenous infusions to supplement fluids and sodium bicarbonate given by mouth. From 2 to 4 gm. of sodium bicarbonate with each dose of sulfonamide is usually sufficient. The amount of fluid is gaged by urinary output.

2. *Serum therapy.*—Specific antiserum against the exotoxin of S. dysenteriae is available and should be used in severe cases of infection with that organism. It is particularly indicated in cases in which the forced administration of parenteral fluids is not adequate to

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control the toxemia. A preliminary intradermal skin test is performed. In the most fulminating cases, the serum is given intravenously, from 40 to 80 cc. being diluted in 500 cc. of physiologic saline solution. In less fulminating cases the intramuscular route may be employed, the same dose being given undiluted. In either case, the dose is repeated twice daily until signs of toxicity such as delirium or apathy have disappeared (*8*).

Specific antisera against the Flexner and Sonne strains are not available. These organisms have no soluble exotoxin. Antibacterial sera, such as those used for diagnostic agglutinations, are ineffective therapeutically.

3. *Infusion and transfusion therapy.*—As with other diarrheal diseases, severe cases of shigellosis may be complicated by shock and hemoconcentration, protein deficiency with a negative nitrogen balance, anemia, acidosis, dehydration, and toxemia. Specific measures are available for each. The experience gained in the treatment of burns during the present war affords a guide to the quantities of saline, plasma, whole blood, sodium bicarbonate, and amino acid solutions to be used in overcoming these states (*16*).

The oral intake of fluids should be supplemented by intravenous administration in amounts sufficient to insure a urinary volume of 1,500 cc. daily. Adequate sodium chloride (10 gm.) is contained in 1,000 cc. or more of physiologic saline solution (9 gm. NaCl per liter). To this dextrose may or may not be added. If large amounts of fluid are needed, that in excess of 2,000 cc. should consist of dextrose dissolved in distilled water. With severe acidosis, supplementary sodium bicarbonate or sodium lactate is useful. Severe dysentery usually requires from 2,000 to 4,000 cc. of supplementary parenteral fluid.

For patients with vasomotor collapse or shock, especially when associated with hemoconcentration, plasma should be given. Any of the following formulas, utilized in the treatment of shock due to burns, are applicable to dysentery (*16*):

(*a*) Give 150 cc. of plasma for each milligram by which the specific gravity of the whole blood exceeds 1.060.

(*b*) Give 100 cc. of plasma for each point by which the hematocrit reading exceeds the normal of 45.

(*c*) Give 50 cc. of plasma for each percent by which the hemoglobin exceeds 100.

(*d*) Give 300 cc. of plasma for each gram of hemoglobin in excess of 15.

(*e*) Give 100 cc. of plasma for each 100,000 erythrocytes in excess of 5,000,000.

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In most cases of severe dysentery, from 500 to 1,000 cc. of plasma is adequate. This should not be given in large amounts until dehydration is relieved. Although plasma can be used as a source of protein for patients with a negative nitrogen balance, it is inefficient for this purpose, as 1,000 cc. contains only 60 gm.

Whole blood is helpful in combating anemia which, due to blood loss in the stools, is a prominent feature of bacillary dysentery. If possible sufficient blood should be given to maintain the red blood cell count at 4 million or over. Usually this requires 500 cc. at 3- or 4-day intervals (*7*).

In most patients with bacillary dysentery who are receiving 10 gm. or more of sodium chloride daily, acidosis is adequately overcome by the selective excretion of chloride ions by the kidneys. Oral sodium bicarbonate, given in conjunction with sulfonamides, is necessary to neutralize or alkalinize the urine. In rare cases of choleriform dysentery, however, acidosis may be so severe as to demand intravenous alkalinization. The following indexes (*16*) are helpful:

For each volume percent that the carbon dioxide combining power of the plasma is less than 55 in a 60-kilogram patient, give one of the following: (a) Forty cubic centimeters of 4-percent sodium bicarbonate solution intravenously; (b) 125 cubic centimeters of 1.3-percent (M/6) sodium bicarbonate solution orally or intravenously; or (c) 125 cubic centimeters of 1.75-percent (M/6) sodium lactate solution orally or intravenously.

4. *Diet and vitamins.*—In the acute stage of dysentery the diet should consist of albumen water or barley water sweetened with lactose. Whole milk is interdicted. These liquids should be given warm and in small amounts. When a more ample diet is tolerated, it should be bland with low residue, high protein, and adequate vitamins. Meat juice and scraped or chopped beef are natural sources of protein. Amino acid preparations are unpalatable, but 100 to 200 gm. a day can be taken by some patients in grape juice or tomato juice. The daily intake of vitamins should include the following:

Vitamin A	10,000 units.
Vitamin B:	
Thiamine	5 mg.
Riboflavin	5 mg.
Niacinamide	5 mg.
Vitamin C	100 mg.
Vitamin D	2,000 units.
Vitamin K (synthetic)	1 mg.

The thiamine and synthetic vitamin K are best given parenterally. All the water-soluble vitamins can be given in this manner. Large doses of crude liver extract (2 units per cc.) are also helpful.

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5. *Symptomatic treatment.*—Abdominal discomfort and restlessness should be relieved by antispasmodic drugs and sedatives rather than by opiates which have a direct effect on the intestinal musculature. The following prescriptions are useful (*7*):

	Gm. or cc.
Tincture of belladonna	8
Sodium bromide	10
Elixir phenobarbital q. s. ad	60

Directions: 1 teaspoonful every 4 hours.

When tenesmus is severe:

	Gm. or cc.
Solution of epinephrine hydrochloride 1:100	3
Benzocaine	3
Cocoa butter q. s. ad	20

Make 10 suppositories.

Directions: 1 every 4 hours as needed.

Heat applied to the abdomen in the form of stupes and hot moist packs is useful in controlling colic and abdominal discomfort. Radiant heat directed over wet packs prolongs and intensifies their effect.

If these measures fail to relieve the patient, morphine may be required. The routine administration of paregoric or deodorized tincture of opium is not recommended, but in cases of dysentery with severe tenesmus, the use of morphine sulfate, ¼ grain or less hypodermically every 4 hours, will often forestall collapse due to exhaustion. Codeine, in larger doses, is also effective.

6. *Sodium or magnesium sulfate.*—The use of a saline cathartic in the initial treatment of mild cases of dysentery is traditional. It should be limited to patients without dehydration or excessive diarrhea and should be used early if at all. Sodium sulfate, the preparation of choice, is given in doses of 4 gm. (60 grains) each morning. It is contraindicated for children and pregnant women.

7. *General measures.*—During the acute phase of dysentery the patient should be at complete rest and be spared the effort of using the bedpan. Instead he should wear a diaper of absorbent cellulose. Nursing care should be directed at maintaining nutrition and fluid intake, conserving strength, preventing decubitus ulcers and hypostatic pneumonia, insuring warmth with adequate covering, recognizing obvious complications, and enforcing sanitary precautions. Nurses and other attendants should wear rubber gloves. Patients should be screened from flies. Linen and gear should be soaked in 5-percent cresol or 10-percent formalin (4-percent aqueous solution of formaldehyde) or sterilized in an autoclave. In general, the same sanitary measures as are used in typhoid fever should obtain.

8. *Prophylaxis.*—The most effective measures in the prevention of the spread of bacillary dysentery are fly control, carrier control, and

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sewage sanitation. These measures alone are adequate provided that they can be fully carried out. Bacterial vaccines are ineffective. Small doses of sulfonamide drugs can be utilized in the control of local outbreaks. Two grams of sulfadiazine daily are suggested. Bacteriophage may prove useful. There is definite evidence from experiments on mice and chick embryos that specific strains of bacteriophage are effective against shigella organisms (*17*).

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EPIDEMIOLOGIC STUDY OF EPIDEMIC HEPATITIS[1]

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On 15 June 1944 the Marine division to which this epidemiology unit was attached entered combat in the Marianas, on Saipan, and later on Tinian Island. All units of the division were removed from these islands between 2 August and 12 August (a 49- to 59-day period since entering combat). During this period bacillary dysentery and dengue were the two major medical problems. The first case of hepatitis did not appear until the first week in August. On 18 August the first elements of the division arrived at the base camp from which the division had departed some 3 months previously. From 18 August through 8 November, 241 men were hospitalized with the diagnosis of epidemic hepatitis.

Initially, all men admitted with this diagnosis were members of the forward echelon; that is, they had participated in the occupation of Saipan, or Tinian, or both. Later it was determined that not more than five of the total admissions were for members of the rear echelon; that is, those who had been present at the rear base camp at least since March. The disease was entirely new to the division; it had not occurred at the base camp (which was the same) following the Marshall Islands campaign in early February. Thus it appeared that some unknown factor which initiated the disease must have been present on either Saipan, or Tinian, or both. On 2 October, the first case was diagnosed from the rear echelon, and later four more occurred. Therefore it appeared that there had been comparatively heavy exposure in the forward echelon and comparatively light exposure in the rear echelon. Since it was a new disease to this division and to its base camp, it seemed reasonable to assume that men in the forward group had in some manner transmitted the disease to men in the rear group.

Inasmuch as this epidemiology unit had been in the forward echelon and thus had had an opportunity to acquaint itself thoroughly with conditions on Saipan, the occurrence of this disease presented an excellent opportunity for study with the hope of deriving some further

[1] From Epidemiology Unit No. 40. Enlisted personnel of the unit included: Chief Pharmacist's Mates Frank Clifton and Raymond Haringa, U. S. N. R.; and Pharmacist's Mates, first class, J. Max Rukes and Stanley Rosch, U. S. N. R.

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information concerning the incubation period and the means of transmission. Accordingly a questionnaire was devised, with questions selected which might give a clue to the source, the incubation period, and the transmission of the disease. Members of this unit personally interviewed 150 of the patients prior to their discharge from the hospital. Some patients were unable to recall all the information requested and some of the records were incomplete. This accounts for the discrepancies noted in some of the totals. It is felt that 150 is a fair sample of the 241 admissions.

DATA FROM QUESTIONNAIRE

The following information was summarized from the completed questionnaires and from the daily sick list reports.

1. Table 1 shows the distribution of cases according to organizations within the division for the 150 cases under study and for the total number of cases admitted.

TABLE 1.—*Distribution of hepatitis in the division, 28 July to 8 Nov. 1944*

Organization*	Questionnaire (sample group)	Hospital admissions (total)
Organization A	21	32
Organization B	12	23
Organization C†	44	84
Organization D	23	25
Organization E	18	29
Organization F	20	31
Organization G	12	17
Total	150	241

*The organizations affected encompassed the entire division.
†44, or 29.3 percent in the sample were from Organization C, and 84, or 34.9 percent of the total hospital admissions were from this same organization.

2. Date joined the division:

Before 1 February 1944	133
After 1 February 1944	15
Total	148

This indicates that all but 15 were members of the division during the Marshall Islands' campaign, February 1944.

3. All of the sample group were on Saipan Island. One hundred thirty-nine landed on or before 17 June, and 10 others landed on or before 24 June.

4. Date landed on Tinian:

24 July (D-day for Tinian)	113
25 July	9
26 July	8
27 July	2
28 July	2

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29 July	2
30 July to 10 August	6
Total	142

Eight were not on Tinian.

5. The entire division was removed from these islands between 2 and 12 August.

6. No relationship could be established between the ship on which they reached Saipan and the cases reported.

7. The information obtained from the questions on typhoid and tetanus inoculations was of no value in this study.

8. Fifteen patients had wounds, and three of these patients required evacuation. They were evacuated on D plus 1, 3, and 9 days. All received plasma prior to evacuation.

9. The following incidence of illness was admitted for the 90-day period preceding hospitalization:

Diarrhea	70
Dengue fever	34
Cold	20
Sore throat	6
Undetermined fever	15
Total	145

10. The distribution of patients according to ship, taken enroute to the base camp is as follows:

Ship No. 1*	34
Ship No. 2	27
Ship No. 3	16
Ship No. 4	15
Ship No. 5*	15
Ship No. 6	13
Ship No. 7	13
Ship No. 8	9
Ship No. 9	2
Ship No. 10	1
Ship No. 11	1
Ship No. 12	1
Total	147

* Ships used to transport Organization C.

11. Fifty-eight patients claimed contact and 86 did not. "Contact" is here interpreted to mean that a friend in the same squad or group developed the disease before the patient in question. The distribution of the 58 with a history of contact is as follows:

Organization A	11
Organization B	3

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Organization C	20
Organization D	7
Organization E	7
Organization F	7
Organization G	3
Total	58

12. All hospital admissions were for at least 1 month.

13. Table 2 shows the distribution, by weeks, when symptoms were first noticed and when admissions occurred in the sample group. Total hospital admissions are also indicated.

TABLE 2.—*Dates symptoms first noticed and hospital admissions for hepatitis in the division, by weeks, 23 July to 8 Nov. 1944*

Dates (1944)	Sample		Total hospital admissions
	Symptoms noticed	Admitted to hospital	
23 July to 29 July	4	1	
30 July to 5 Aug	1	0	
6 Aug. to 12 Aug	13	3	
13 Aug. to 19 Aug	26	13	
20 Aug. to 26 Aug	41	26	*27
27 Aug. to 2 Sept	35	57	60
3 Sept. to 9 Sept	17	29	43
10 Sept. to 16 Sept	6	16	28
17 Sept. to 23 Sept	1	2	21
24 Sept. to 30 Sept	1	0	24
1 Oct. to 7 Oct	1	1	10
8 Oct. to 14 Oct	2	1	10
15 Oct. to 21 Oct	0	1	5
22 Oct. to 28 Oct	4	2	5
29 Oct. to 4 Nov	0	3	6
5 Nov. to 8 Nov	0	0	†2
Total	‡§152	‡§155	241

*3-day period only, 24-26 Aug. 1944.
†4-day period only.
‡Includes 5 patients who were not in the Marianas' operation.
§Discrepancy in totals because 3 patients could not establish dates of the onset of symptoms.

14. *Signs and symptoms.*—In most cases the prodromal period or pre-icteric phase was initiated with chills and fever followed by nausea and vomiting, eyeache, backache, headache, and aching or stiff joints. These were accompanied by a severe anorexia of a few days' duration, and at the time a patient appeared improved there would occur another rise in temperature and the first clinical evidence of jaundice. In many, especially when the first patients were admitted, an erroneous diagnosis of dengue or catarrhal fever was made at the onset of the illness. Most patients showed a period of from 4 to 5 days between the appearance of the first symptom and the appearance of clinical jaundice. Practically all patients felt much improved after the appearance of jaundice. In all but two or three instances the temperature did not exceed 103° F. One of the patients became acutely ill and had a high temperature followed by convulsions. There were no deaths, and aside from the three mentioned, none of the patients ap-

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peared acutely ill at any time. All patients were hospitalized and routine upper respiratory precautions were observed for the first week. They were then transferred to a hospital annex for a period of from 3 to 4 more weeks.

The incidence and order of occurrence of symptoms is shown in table 3. When several were reported as occurring simultaneously, all were given the same number.

TABLE 3.—*Hepatitis symptoms in 152 cases*

Symptoms	Reported	Not reported	Percent reported	Order of occurrence					
				1	2	3	4	5	6
Chills and fever	121	31	79.6	51	34	29	6	1	
Nausea	113	39	74.3	48	34	23	8		
Vomiting	113	39	74.3	27	41	20	18	6	1
Eyeache	105	47	69.1	24	41	26	12	1	1
Backache	99	53	65.1	28	36	20	11	4	
Headache	93	59	61.2	34	31	21	7		
Anorexia	58	94	38.2	27	22	8	1		
Aching and/or stiff joints	40	112	26.3	14	16	7	3		
Rash	31	121	20.4	6	11	4	6	2	2
Abdominal pain	18	134	11.8	4	12	2			
Diarrhea	8	144	5.3	5	2		1		
Constipation	6	146	3.9	2	2	2			
Sore throat	1	151	0.7			1			
Convulsions	1	151	0.7						
Jaundice	152	0	100.0	3	6	31	54	46	12

Physical examinations, as recorded in the hospital charts revealed very little. Aside from the icteric tint to the skin and scleras which was present in all, many had tenderness in the epigastrium, and in some the liver edge was palpable at or just below the costal margin. The exact incidence of liver enlargement was not determined.

15. *Laboratory findings.*—No extensive laboratory studies were performed on these patients. The following laboratory results were recorded in the charts of the 150 cases in this sample group:

Leukocyte count	*Number of patients*
9,000 to 9,990	5
8,000 to 8,990	4
7,000 to 7,990	16
6,000 to 6,990	37
5,000 to 5,990	49
4,000 to 4,990	27
3,000 to 3,990	6
Total	144

Lymphocytes	*Number of patients*
20 to 35	49
36 to 45	57
46 and over	36
Total	142

Urobilinogen determinations were made on all patients in this group and all were positive in dilutions ranging from 1:20 to 1:100.

With the exception of three, none of the patients appeared sick enough to warrant suspecting Weil's disease and therefore routine darkfield examinations were not performed. Darkfield examinations made on blood from three of these patients showed no leptospira.

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No patients showed evidence of anemia from the erythrocyte counts and hemoglobin determinations.

Icteric index:

Index	Number of patients	Index	Number of patients
10 to 14	0	65 to 69	7
15 to 19	7	70 to 74	4
20 to 24	11	75 to 79	1
25 to 29	6	80 to 84	6
30 to 34	13	85 to 89	2
35 to 39	8	90 to 94	1
40 to 44	16	95 to 99	1
45 to 49	13	120 to 124	1
50 to 54	17		
55 to 59	13	Total	145
60 to 64	18		

Mean icteric index 48.6
Standard deviation 19.1

When more than one determination appeared on a patient's chart, the highest figure was recorded. Five other patients were jaundiced, but an icteric index was not determined.

COMMENT

Recent years have seen many articles in the medical journals describing an illness variously called epidemic hepatitis, infectious hepatitis, acute infectious hepatitis, and acute infective jaundice. According to Navy nomenclature, any epidemic type of jaundice other than Weil's disease is called acute infectious jaundice. Actually it appears these terms apply to the same disease and possibly are identical to what has been called "acute catarrhal jaundice." The more correct term seems to be epidemic hepatitis, as it is an infectious disease that may occur in epidemics, and the pathologic change (*1*) is a parenchymatous inflammation of the liver. Since the pathologic change is a hepatocellular necrosis, there is no justification for the term "catarrh" nor is the term "epidemic jaundice" correct, inasmuch as it is likely that some individuals are infected and never develop jaundice.

The clinical course of the disease described here parallels that described by Logan (*2*), Havens (*3*), and Cohen (*4*). Havens reviews 200 clinical cases at an American military hospital in the Middle East. He states that in the pre-icteric phase, malaria and sandfly fever were the two diseases most frequently considered in the differential diagnosis. In the series presented here, dengue and mild upper respiratory infections were most frequently encountered. In Cohen's series of 360 cases from the Pacific area, dengue was also considered in the early differential diagnosis. Thus it would appear that local virus diseases must be considered in the pre-icteric differential diagnosis.

All investigators seem fairly well agreed that it is a virus disease.

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Certainly the relatively long incubation period, the clinical course, and the laboratory evidence, both positive and negative, point to a virus infection. Seide and Luz (*5*) claim to have cultivated from duodenal fluid of patients with epidemic hepatitis a specific agent whose behavior made it a filtrable virus. So far as is known this has not been confirmed by others, although several French investigators have concluded it is caused by a virus which is present during the pre-icteric phase in the saliva, the upper respiratory passages, and the blood.

Incubation period.—A wide variation of estimated incubation periods is given in the literature. Experimental transmissions effected by Findlay and Martin (*6*) through intranasal instillation gave incubation periods up to 120 days in the yellow-fever vaccine cases. Havens et al. (*7*) were able to transmit the disease by three routes: Three patients were infected by intracutaneous injection after an incubation period of from 56 to 70 days; three more were infected by intranasal instillation of sera suspected of containing the icterogenic agent after an incubation period of 30 days for two, and 84 days for the third; and two were successfully infected by ingestion of urine and stool extracts from patients in various stages of epidemic hepatitis after incubation periods of 20 and 22 days. Thus it appears, experimentally, that the incubation period may vary with the portal of entry.

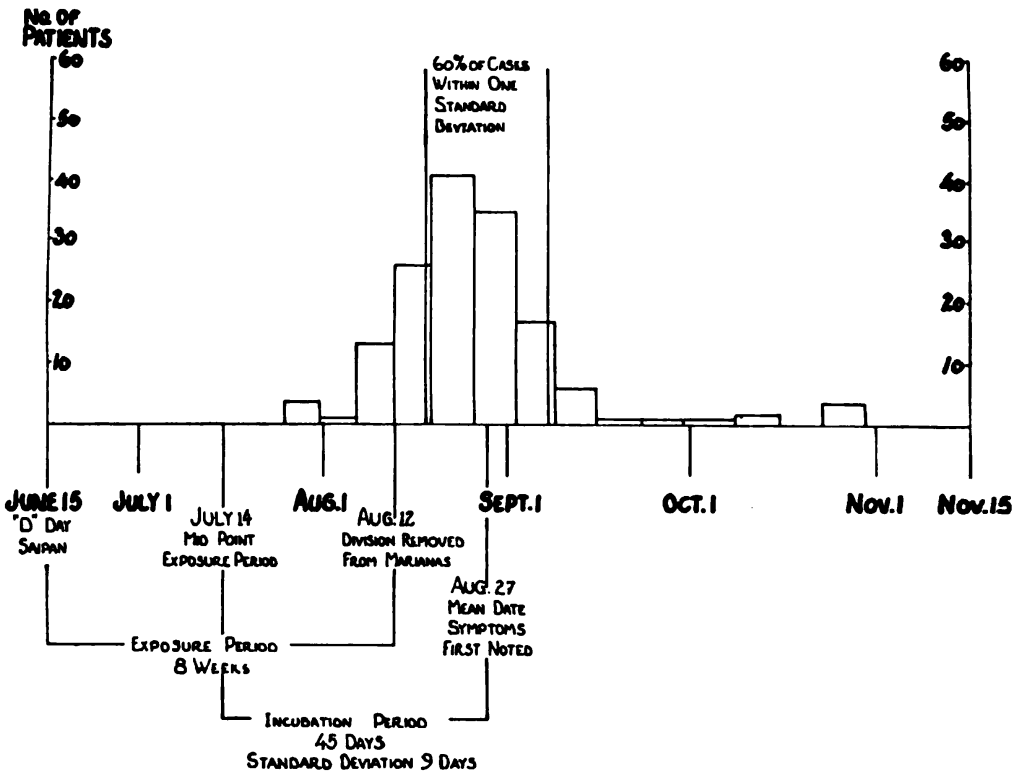
The most probable time of infection for this epidemic was the period spent in the Marianas Islands, Saipan, and Tinian. The initial landings on Saipan were made on 15 June and the last of the division left the islands on 12 August 1944. This gives a maximum possible exposure period of 8 weeks.

Admissions began shortly before leaving the islands, and continued on board ship and on return to the base camp. It has been determined that a great majority of the patients were ill for a number of days prior to admission. They had fancied themselves to have, or had been told they had, catarrhal fever or dengue.

If a tabulation is made of the dates on which symptoms were first noted by the sample group (table 2), it is seen to be a nearly symmetric distribution with a range of 8 weeks, from 23 July through 16 September, and has a clear trend toward central grouping. The mean date is 27 August, 45 days after the midpoint (14 July) of the "exposure period" spent in the islands, and the standard deviation is 9 days. Statistically, in any normal distribution, two-thirds of the cases would be expected to appear within one standard deviation, which in this instance is between 18 August and 5 September. Actually 60 percent of the sample in this 8-week period occurred within one standard deviation (36 to 54 days). Graph 1 illustrates this chronologically.

It might be expected that with the introduction of a number of infected personnel among a new and susceptible group, new cases

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GRAPH 1.—The exposure period in the Marianas Islands in relation to the incubation period of epidemic hepatitis and the dates symptoms were first noted by the sample group of 150 patients. Source: Table 2 and discussion on incubation period.

would appear. Such a condition occurred when the division was removed from the islands of Saipan and Tinian and transported by ship to the base camp, a trip that required approximately 2 weeks. In the case of Organization C (34.9 percent of the total admissions were from this organization) 2 ships were used for transportation to the base camp. There were 25 patients from this organization, not included in the sample group, who were hospitalized between 19 September and 16 October. Assuming their exposure occurred on board ship, a mean incubation period of 45 days with a standard deviation of 9 appears reasonable.

As nearly as could be determined, there were 5 admissions from personnel of the rear echelon. One had his first symptoms on 24 September, one on 23 October, one on 24, one on 25, and one on 27 October. Assuming the forward echelon provided the source of infection for members of the rear echelon, then the period of exposure must have begun on 25 August when the bulk of the forward group returned. Forty-five days after 25 August is 9 October. Applying the results of the sample studied, no more than 1 case out of 6 would be expected to occur before 2 October and no more than 1 out of 30 before 25 September. That 1 case did occur on 24 September does not disprove this hypothesis.

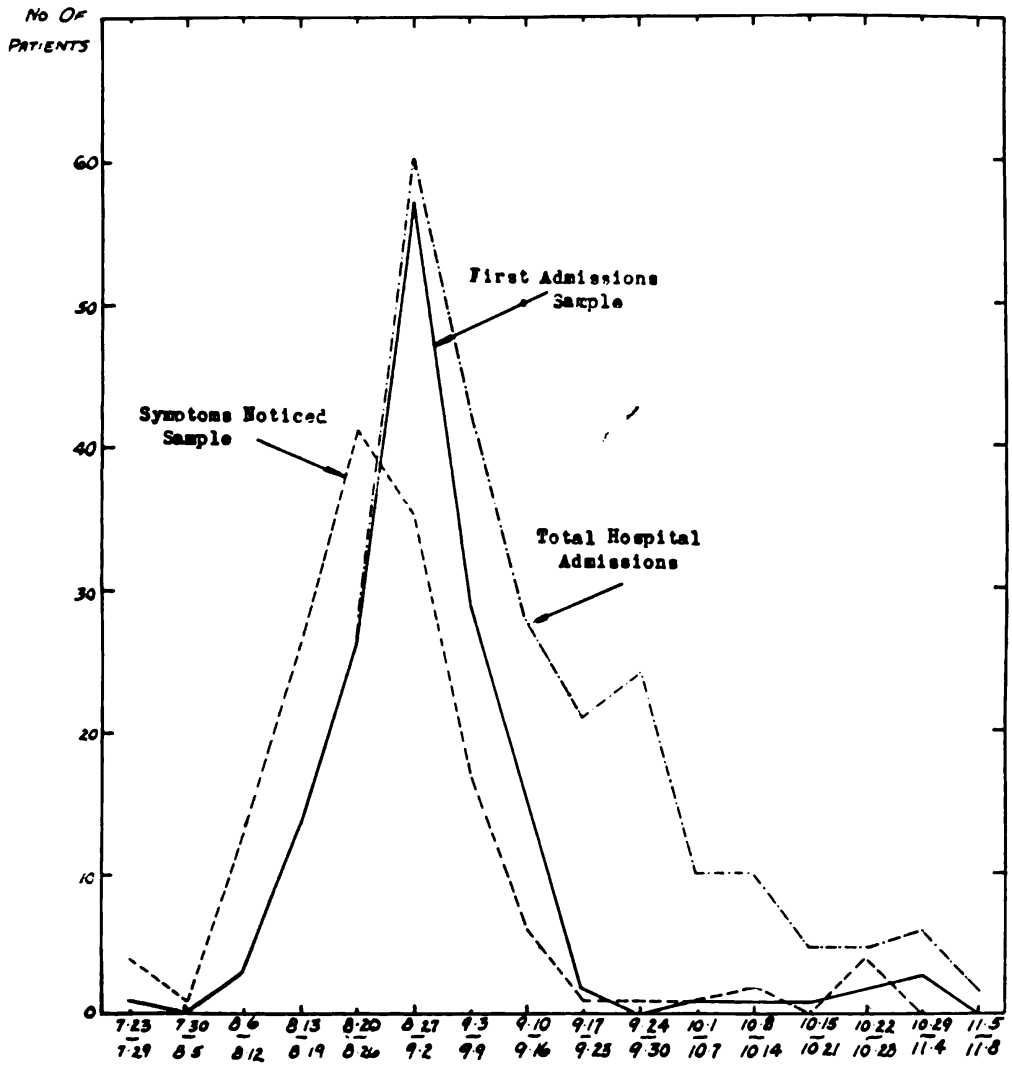
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As the period of exposure could not be determined accurately for this susceptible rear echelon group, it was expected that cases might continue to occur. However, living conditions in a tent camp meant that contact was not as close as that on board ship or in barracks and therefore the number of new cases was expected to decrease rapidly, and this did occur.

Graph 2, based on the data in table 2, shows the date symptoms were first noted and the date of the first admission for the 150 cases studied in the sample. The total hospital admissions are also indicated.

TRANSMISSION

1. *Respiratory.*—Experimental transmissions of epidemic hepatitis by methods involving intranasal instillation suggest that natural in-



GRAPH 2.—Dates by weeks of symptoms noted and of admissions, 23 July to 8 November 1944.

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fection might occur by this route. In a very complete study of hepatitis transmitted by the injection of homologous blood products to human volunteers, Neefe and his associates (*8*) mention two possible contact cases in hospital employees. In their discussion it is stated that, "The two cases reported by Propert and the two possible cases cited herein apparently represent the only recorded instances in which contact infection may have occurred under natural circumstances."

The respiratory route seems to offer the most satisfactory explanation for transmission in this epidemic. The best evidence in favor of this is presented in the discussion on the incubation period and the evidence to follow against an enteric portal of entry. It would be difficult to explain how the 25 men in Organization C, who were apparently infected on board ship enroute to the base camp, could have been infected in any other manner. If, for example, the enteric route were responsible, it would infer that the food or water had in some manner been contaminated, in which case, since the food and water were standard, more than 25 men would probably have been infected during the exposure period on board ship.

It is further noted that of the total admissions, 84 or 34.9 percent were from Organization C. Also 58 patients in the sample of 150 gave a history of contact, and 20 (34.5 percent) of these were in this organization. Again it would be difficult to explain these infections on an enteric basis. An enteric portal of entry would imply that the water or food was responsible and these two items were in the main identical for the entire division. However droplet infection through the upper respiratory tract could account for the transmission.

The question arises as to why Organization C did have the greatest number of cases. There does not appear to be any clear answer to this, but it is known that this organization spent more time in and near one of the Japanese native villages on Saipan. It is possible that the virus was more prevalent in that vicinity, either from the former residents or their domestic animals. The decaying carcasses of cattle and hogs were more noticeable and caused more complaints in this area than elsewhere.

The statement occasionally appears that patients should be isolated during the pre-icteric phase of the disease. Since a great number of these cases were not diagnosed until the appearance of clinical jaundice, transmission to other susceptibles was possible prior to admission. When they were hospitalized, isolation with precautions for upper respiratory infections was routine for the first week. It is interesting to note that none of the staff or attendents contracted the infection.

2. *Enteric.*—It has been reported from the Mediterranean area and the South Pacific that certain military units with a high incidence of bacillary dysentery had, in the next month or two, a number of cases of hepatitis. This might suggest that bacillary dysentery caused a

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greater susceptibility to hepatitis or that the route for infection was enteric. It also infers fecal contamination of food and water or both with the causative agent. It has been established by Havens and his associates and by others, that oral transmission to human volunteers is possible by feeding fecal suspensions from clinical cases.

On Saipan and Tinian the only water authorized for drinking purposes was obtained from previously filled and approved containers or from other recognized sources such as ships and shore distillation points. These sources were common to the entire division. Food was in the form of standard rations and was issued to all personnel.

TABLE 4.—*Hospital admissions, by organization, for bacillary dysentery, dengue, and epidemic hepatitis*

Organization	Bacillary dysentery 20 June to 6 Aug.	Dengue 26 June to 6 Aug.	Epidemic hepatitis 25 Aug. to 8 Nov.
Organization A	16	42	32
Organization B	48	41	24
Organization C*	105	59	84
Organization D*	119	46	25
Organization E*	246	44	29
Organization F	50	84	17
Organization G	26	55	30
Undetermined organization	237	85	.....
Total	847	456	241

*Infantry regiments.

During the assault phase, bacillary dysentery was common. Table 4 compares the admissions, by organization, for bacillary dysentery, dengue, and hepatitis. Data from the questionnaire revealed that 70 of the 150 cases of hepatitis gave a history of diarrhea. However if bacillary dysentery were associated with epidemic hepatitis, a greater incidence of hepatitis might be expected in Organization E (table 4), inasmuch as it had the greatest admissions for dysentery. The figures show that E had one of the lowest admissions for hepatitis and the lowest for an infantry regiment, whereas C had less than half the amount of dysentery and more than twice the amount of hepatitis.

In March and April of 1944, this Marine division had an epidemic of bacillary dysentery and many men were hospitalized for diarrhea or dysentery. The shigella organism responsible was the Flexner type identical to the one which caused dysentery on Saipan (*9*). During the epidemic and for more than 4 months following, no member of the division was hospitalized with a diagnosis of epidemic hepatitis.

While on Saipan this unit did 496 stool cultures on hospital admissions for dysentery or diarrhea and found 77 of them positive for the same type of shigella organism. So far as is known, none of the patients in this sample of 150 cases of hepatitis was in the group on

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whom cultures had been done on Saipan, and it is known that none of the 77 positives was in this group.

Five of the total admissions for hepatitis were from the rear echelon. They had not been exposed to dysentery on Saipan or Tinian, nor did they have a history of diarrhea or dysentery. Thus it can be definitely stated that no relationship existed between this epidemic and shigella-type dysentery .

Two patients from the sample group were wounded and evacuated from Saipan on D+1 and +3 days. While on Saipan they ate only K rations and drank only water which had been obtained from a ship or from containers originally filled at the base camp. It would be difficult to state how these men became infected.

3. *Insect vector.*—In view of certain factors, this possibility warrants consideration. The two insects common on Saipan and Tinian were mosquitoes and flies. If the latter were vectors, transmission would be mechanical, involving the contamination of food or water; thus it would again be a question of ingestion. If the mosquito were responsible, it could be a true biologic vector.

There did appear to be a close resemblance of hepatitis to dengue. Thirty-four of the patients in this series gave a history of dengue. When the first cases occurred, there were many instances of misdiagnosis, and it was not until icterus appeared that a true diagnosis was made. At one time some medical officers thought the icterus might be a later manifestation of dengue; however this complication is evidently rare and the possibility was not accepted.

Again referring to Organization C, it is noted (table 4) that it had slightly more dengue than did any other similar organization. On Saipan the personnel of this organization spent more time in and around the native village previously mentioned where the incidence of the aëdes mosquito was the greatest. If hepatitis was transmitted in the same manner, they would also be expected to have the greatest amount, and the incidence shows this to be true. This does not, however, adequately explain why the same regiment had the greatest number of admissions at the base camp. In order to explain the latter, it is necessary to assume that infection either occurred at the base camp, since mosquitoes were not present on board ship, or that the incubation period as herein determined was incorrect. Transmission at the base camp implies that the same variety of mosquito must have been present at the camp as was found on Saipan and Tinian. The two mosquitoes on Saipan responsible for dengue were Aëdes albopictus and A. aegypti. This unit never found A. aegypti within the limits of the camp, although it had been reported present on the island, and A. albopictus was only rarely found. No cases of dengue were known to have occurred in the section in which the base camp was located.

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This low mosquito index, together with the use of bed nets, makes the possibility of mosquito transmission seem less likely.

SUMMARY AND CONCLUSIONS

1. An epidemiologic study of 150 cases from a total of 241 admissions for epidemic hepatitis was made.

2. It is believed the mean incubation period for this epidemic was 45 days, with a standard deviation of 9. Sixty percent of the cases in this series occurred between 36 and 54 days.

3. Transmission via the upper respiratory route seems to offer the most satisfactory explanation for the spread of this epidemic.

4. It can be stated definitely that no relationship existed between this epidemic and a previous epidemic of bacillary dysentery caused by Shigella paradysenteriae, var. Flexner.

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THE COPPER IONIZATION TREATMENT OF FUNGOUS INFECTIONS

WILLIAM J. LAHEY
Lieutenant (MC) U.S.N.R.
and
JAMES E. BYRNES
Commander (MC) U.S.N.R.

Fungous infection of the skin is recognized as a major medical problem in the military forces, especially among those operating in tropical and subtropical areas. Its high incidence, the lack of a uniformly effective method of treatment, and the frequent occurrence of secondary disability from "overtreatment," combine to rate it highly among the causes of lost man-hours.

This paper is a report of 6 months' experience in the use of the copper ionization bath as described by Knox.[1] During this period, 154 cases from the personnel of a Naval construction battalion at an advanced base in the Pacific were treated.

SELECTION AND MANAGEMENT OF CASES

In this series only those patients with moderate to severe involvement of the feet and/or hands were treated. The types of infection handled were two; i. e., the common interdigital, with and without extension, and the dyshydrotic or thick-walled blister types. Cases with secondary infection are not included. All but two cases were managed as outpatients.

A card was kept on each individual from the inception of treatment until disposition. This record contained statements as to type and extent of infection, duration, history of previous episodes, and types and duration of treatment already undergone. Notes were made as to objective and subjective changes throughout the course of therapy.

No other forms of treatment were used in this series. The hospital corpsmen gave repeated instruction in foot care and hygiene while the individual treatment was in progress, stressing the sunning and drying of shoes, frequent changing of socks, and meticulous drying of the feet after washing.

[1] KNOX, S. C.: Improvised method of management of fungus infections of the feet. U. S. Nav. M. Bull. 41: 1746-47, November 1943.

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Treatments were given on alternate days, beginning with a test period of 2 minutes to detect the presence of copper sensitivity. Subsequent treatments covered 6 minutes. The affected parts were carefully dried afterward and dry sterile dressings applied to raw, weeping lesions. None of the numerous "prophylactic" foot powders were employed between baths.

Facilities were not available for cultural studies. Diagnoses were made by the usual clinical criteria.

TECHNICAL CONSIDERATIONS

The baths were constructed and operated after the plan presented by Knox, with several minor additions. Sheet copper was used instead of copper coils, and latticed wooden shells were inserted as insulation between the copper and the skin of the feet. Rheostats and milliammeters obtained from salvage were attached, and 2 indifferent electrodes were used to enable treatment of both feet simultaneously. Three baths were employed to facilitate further the handling of the group. The four 1½-volt dry cells were replaced after 120 treatments. The 0.2-percent copper sulfate solution was changed weekly.

It was found early that removal of the blister tops hastened response to treatment in the dyshydrotic type of infection.

SIDE REACTIONS

No reactions ascribable to copper sensitivity were encountered. Several patients initially developed transient follicular rashes at the points of application of the indifferent electrodes, but these in no case persisted or recurred.

Almost universally the patients described an itching, burning or stinging sensation during the treatment. A considerable number complained of increased itching in the interim between the first and second sessions. This disappeared after the third treatment.

RESULTS

The over-all results are summarized in table 1.

Cases were classified as completely healed when all lesions had disappeared and the skin had regained a wholly normal appearance. Those cases in which all the acute features such as blisters, redness, weeping, and itching had vanished, but in which the skin showed persistent scaling or fissuring were considered significantly improved. Cases which were not helped after six treatments were classified as failures. These uniformly were subacute cases with a history of many spontaneous exacerbations and remissions but no other distinguishing features.

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The dyshydrotic type proved considerably more resistant to treatment, a situation universally experienced with other forms of therapy.

The fact that 23 percent of the cases showed persistent skin changes after disappearance of acute signs, points out a limitation of the method. In cases treated subsequent to this series, the judicious use of keratolytic agents at this stage has completed the healing process.

Chronic cases generally responded well. Dramatic results were obtained in two instances of extensive involvement of the feet which had existed for over a year and had failed to improve under various regimens. It is perhaps significant that many of these patients felt constrained to express their appreciation of the results.

TABLE 1.—*Results of treatment*

Result	Interdigital type	Dyshydrotic type	Total	Percentage of total
Complete healing	66 (78%)	33 (48%)	99	65
Significant improvement	12 (14.5%)	24 (35%)	36	23
Failure	7 (8%)	12 (17%)	19	12

TABLE 2.—*Number of treatments required*

Type	Range	Average	Average time under treatment (days)
Interdigital	2-10	6	13
Dyshydrotic	4-12	8	17

Epidermophytids were seen in six cases of the dyshydrotic type. They carried no untoward prognostic significance and regressed in all instances coincidentally with improvement in the original lesions.

The number of treatments required is indicated in table 2.

Fifty-two men were available for examination on an average of 2 months after completion of treatment. Three showed activity. These were members of the group classified above as significantly improved, and all three responded satisfactorily to a second course, averaging four treatments.

CONCLUSIONS

1. Our experience indicates that the copper ionization bath is a safe and valuable method of treatment of fungous infection of the types described.

2. An appreciable number of cases shows persistent scaling or fissuring of the skin despite disappearance of all acute signs. These require the supplementary use of keratolytic agents to complete the healing process.

3. The method possesses certain advantages over the usual forms of

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therapy. Chronic cases are generally benefited. The vexing problem of "overtreatment" is by-passed. The procedure is simple and uniform in its application. The apparatus necessary is easily constructed from scrap material and requires little servicing. The over-all cost of treatment is minimal.

These factors are of particular significance in military medicine.

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LOCAL APPLICATION OF PENICILLIN IN POST-EXTRACTION INFECTION

A white male patient, 25 years of age, presented himself at this dispensary, with a horizontally impacted lower right third molar. He gave a negative history as to any infection. Intra-oral x-ray studies were made, and surgical removal of the impacted tooth was considered advisable. This was accomplished on 22 February 1945, using procaine hydrochloride with epinephrine (2-percent solution) as a local anesthetic. The tooth was removed in toto, the alveolar process was smoothed with bone files, the socket cleansed of debris, and the entire exposed area frosted with powdered sulfathiazole (U. S. P. 12). The incision was then closed with two sutures. The patient was taken to the sickbay and ice packs were applied externally to the area for 20 minutes at 20-minute intervals.

Forty-eight hours later the patient was returned to the dispensary. There was only slight edema and no complaint of pain. The sutures were removed and the socket was mechanically cleansed with a warm solution of mouthwash by means of a sterile chip blower. The socket was dressed with butyn metaphen, and a sterile gauze strip placed over it.

The patient was returned to duty, and the above-described treatment was repeated every 3 days. Recovery seemed uneventful until 6 March 1945, the twelfth postoperative day, when the patient had edema and pain. The dressing was removed, and several cubic centimeters of pus were evacuated. Intra-oral and extra-oral roentgenographs showed the socket to be clean and free of loose pieces of bone. The patient's temperature was 99.8° F.

At this time the topical application of penicillin was decided upon. The socket was cleansed mechanically with warm normal saline solution, then washed with a solution of penicillin, 250 units per cubic centimeter, by means of a sterile chip blower, and again dressed with butyn metaphen. The patient was dismissed and returned 4 hours later. Again the socket was cleansed as before, and penicillin was again applied locally.

The next morning the fever, pain, and edema had disappeared. There was no evidence of pus, and none could be expelled upon application of pressure.

The socket was dressed every third day with a surgical paste dressing, and the patient was dismissed on 14 April, further healing having been uneventful.—WATKINS, RICHARD S., Lieutenant (DC) U. S. N. R.

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ABDOMINAL WAR WOUNDS[1]

REPORT OF TEN CASES WITH RECOVERY

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This is the report of the laparotomies performed upon patients received directly from the battlefields at Iwo Jima, Bonin Islands, from 24 to 26 February 1945. The ship stood off the island receiving casualties for 48 hours. All the patients with abdominal wounds were operated upon during a consecutive 50-hour period. An eleventh laparotomy was performed upon a patient with an abdominal wound, but he did not survive. Seven patients with multiple intestinal perforations received surgical treatment without fatality. The 10 post-laparotomy patients put ashore on the third and fourth postoperative days were making satisfactory progress when seen on the seventh and eighth postoperative days.

The ship evacuated 614 patients from Iwo Jima. The 11 abdominal explorations reported were part of a total of 40 miscellaneous operations performed in the same 50-hour period. The x-ray unit was a portable one with which it was almost impossible to obtain a satisfactory lateral chest or lateral abdominal exposure on anyone except a thin or small-statured person. The decision to perform laparotomy on abdominal wounds was made chiefly from the physical findings.

One laparotomy was performed under a spinal (procaine) anesthetic, and in the remaining 10, ether by the drop method was used. Small bowel perforations less than 1 cm. in extent were simply inverted with mattress sutures of fine silk. Larger perforations were closed with a running mucosal suture of No. 00 chromic catgut mounted on an atraumatic needle, reinforced with interrupted mattress sutures of fine silk. About 10 gm. of crystalline sulfanilamide was used intra-abdominally in every case, with an effort to distribute it in a fine covering or "frosting" over the serosal surfaces of the bowel, and in the wound during closure. From 250 to 750 cc. of plasma, and from 500 to 1,000 cc. of whole blood were administered during the operation in all cases with viscus perforation.

All patients were operated upon in the precedence with which they came aboard. Only one patient had been wounded longer than 8

[1] Received for publication April 1945.

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hours when he came to surgery (case 10). Only two of the operations consumed more than 2 hours.

Routine postoperative treatment consisted of administration of 20,000 units of penicillin subcutaneously or intramuscularly every 3 hours, sodium sulfadiazine (in 5-percent dextrose in saline solution) in 5-gm. doses intravenously, twice daily, and from 3,000 to 4,000 cc. of 5-percent dextrose in saline infusions every 24 hours. Morphine in ⅙-grain doses was given for pain. Wangensteen suctions were set up, but all patients were extremely uncooperative about leaving the nasal suction tubes in place.

It is realized that a satisfactory postoperative course on the seventh or eighth day does not guarantee complete, uncomplicated recovery from traumatic intestinal perforation. These 10 patients were evacuated to the same fleet hospital. The 10 cases with recovery are briefly reported as follows:

CASE REPORTS

Case 1.—A Marine corporal had a wound, about ½ cm. in diameter, near the midline of the lower portion of the abdomen. There was no other abdominal or flank wound, but there was a through-and-through wound of small caliber in the distal third of the right forearm with an obvious fracture of the ulna.

There were three perforations, less than 1 cm. in diameter, in the 12 inches of jejunum distal to the ligament of Treitz. A similar perforation was present approximately at the junction of the proximal and middle third of the ileum. There were three perforations, 1 cm. or larger (but none as great as half of the circumference of the bowel), in the mid-ileum. There were no other viscus perforations. The missile was not found.

The abdomen was explored through a mid-abdominal rectus incision. The four proximal perforations were closed with inverting mattress sutures of fine silk placed in the transverse direction of the bowel. The three lower perforations were closed, using first a mucosal suture of fine chromic, followed by inverting mattress sutures of silk. The abdomen was closed without drainage. A wick of vaseline gauze was introduced through the wound of entrance as deep as the rectus muscle. Similar vaseline gauze wicks were placed in the wounds of the right forearm. A forearm plaster cast was applied as far as the elbow. One thousand cubic centimeters of plasma and 500 cubic centimeters of whole blood were given during the procedure.

This was the only patient who tolerated a Wangensteen suction. When seen on his eighth postoperative day, he had passed gas rectally and was taking fluids by mouth. His wound healed per primam.

Case 2.—A Marine private had a wound of about ¼ inch in the left mid-lateral portion of the abdomen. X-ray study showed evidence of a small foreign body on the left side of the abdomen. Extraperitoneal hemorrhage was present in the left abdominal wall without perforation of the parietal peritoneum or of the abdominal cavity. The foreign body was not palpable in the abdominal wall.

Through a mid-abdominal left rectus incision, the abdomen was explored and closed. Postoperatively fluids were permitted by mouth as soon as peristalsis had started. The patient's recovery was uneventful and on the eighth postoperative day he was ambulatory and the wound was well healed.

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Case 3.—This Marine private had a frank evisceration of about 4 feet of ileum through a ragged wound, approximately 2 by 4 cm., in the right lower quadrant of the abdomen. The exposed ileum was completely transected in one area and contained other small perforations. The serosal surface was sprinkled with volcanic ash. There was a circular wound, 2 cm. in diameter, in the right gluteal region.

At operation the site of transection of the ileum was about 2 feet proximal to the ileocecal valve. The adjacent mesentery had a 4-cm. radial tear and a hematoma in an area supplying about 16 cm. of ileum. The posterior parietal peritoneum of this area was lacerated, but the iliac vessels were intact.

The loops of ileum were carefully washed with normal saline solution, and the abdomen was prepared for laparotomy. Through a right rectus incision the remainder of the abdomen was explored. About 16 inches of ileum was resected to include all of the damaged ileum and mesentery. The bowel was divided between Kocher clamps, using phenol-alcohol sterilization. The mesentery was closed with interrupted sutures of fine chromic catgut. With the proximal and distal segments of the bowel held adjacent, the contramesenteric serosal surfaces were approximated for a distance of about 6 inches with interrupted silk sutures. The lacerated parietal peritoneum in the right cecal and iliac fossae was closed with fine sutures of chromic catgut. Penrose drains were introduced through the right lower abdominal quadrant wound to the retroperitoneal area. The divided ends of the ileum with clamps attached were then delivered into the incision, which was closed about them. A vaseline gauze drain was placed in the right gluteal wound. Five hundred cubic centimeters of plasma and 1,000 cubic centimeters of whole blood were given during the procedure.

On the third postoperative day, the clamp on the proximal end of the ileum was removed. The clamp on the distal portion was removed in the hospital a few days later. On the seventh postoperative day the proximal ileum was functioning.

Case 4.—This Marine private had a small wound in the left mid-lateral portion of the abdomen. A second small wound was present at approximately the same level in the left posterior flank.

A laceration, 1 cm. in length, was present in the mid-ileum. One-half the circumference of the mid-descending colon was lacerated, with resultant gross fecal contamination of the abdomen.

Medial to the external wound, a lower left rectus incision was made. The perforation of the ileum was closed with mattress sutures of fine silk. The colon was then explored. The laceration of the mid-descending colon was closed with a kidney pedicle clamp. The splenic flexure of the descending colon was mobilized sufficiently to permit deliverance of the injured colon with its attached clamp through the wound without tension. A Penrose drain was placed in the retroperitoneal space through the flank wound and the incision was closed about the loop of bowel. The skin was not sutured. One thousand cubic centimeters of whole blood was given during the operation.

On the third postoperative day the patient was evacuated from the ship. There was still moderate abdominal distention, and he had a fever of 104° F. On the seventh postoperative day, the temperature had subsided to 101° F. The clamp had been removed and the colon was emptying. Peritonitis was still present. This man had the stormiest postoperative course of any of the cases presented, but it was believed that his chances of survival were good.

Case 5.—A Marine corporal had a skin wound the size of a .25-caliber bullet just to the left of the midline in the epigastrium. A wound about twice this

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size was present between the eleventh and twelfth ribs in the right lateral portion of the abdomen.

In addition to considerable hemorrhage, there were undigested K rations and bile in the upper right part of the abdomen. There was active hemorrhage of some of the right gastro-epiploic vessels just proximal to the pylorus. The middle colic vessels were intact. There was a 2-cm. tear in the dome of the gallbladder, and a 3-cm. superficial laceration of the undersurface of the right lobe of the liver. A 2-cm. laceration was found in the duodenum at the junction of the second and third portions. There was subserosal hemorrhage but no perforation of the hepatic flexure of the colon.

An upper right rectus incision was made. Considerable fresh and clotted blood was evacuated. The bleeding gastro-epiploic vessels were isolated and ligated. The gallbladder laceration was closed with a running suture of fine chromic catgut, reinforced with interrupted mattress sutures of silk. Mobilization of the duodenum exposed its laceration, which was similarly closed. The incision was closed without drainage. One thousand cubic centimeters of whole blood was given before surgery, and 500 cubic centimeters was administered during the operation.

On the seventh postoperative day, the patient was taking fluids by mouth. His bowels had moved. His wound healed per primam.

Case 6.—A Marine private, first class, showed a ragged wound of entrance in his right groin. The femoral vessels were intact. Roentgenograms showed numerous shell fragments of all sizes in the lower part of the abdomen. There was a comminuted compound fracture of the upper third of the right femur, which was maintained in good position in a splint. A wound, 3 cm. in diameter, on the dorsum of the right wrist exposed a comminuted compound fracture of the radial styloid process. A wound less than 1 cm. in diameter was present on the volar aspect of the wrist near the ulnar styloid. The right thigh had several puncture wounds.

No perforations of the parietal peritoneum were found at operation. All of the shell fragments were in the abdominal wall. Several of these were palpable in the left lower quadrant. Although there were no perforations of the small bowel, there were two areas of subserosal hemorrhage.

The abdomen was explored through a lower midline incision. One of the traumatized areas of the ileum was inverted with mattress sutures of silk. After the incision had been closed, small wicks of vaseline gauze were placed in the various skin lacerations. The right forearm wound was excised and irrigated with normal saline solution. Sulfanilamide crystals and a loose vaseline gauze dressing were placed in the wound. After alinement of the fracture a plaster cast was applied up to the elbow.

This patient had abdominal distention and vomiting for a few days which was relieved by Wangensteen suction. On the seventh day he was taking fluids by mouth.

Case 7.—This Marine private, first class, had a wound, 2 cm. in diameter, in the upper left gluteal region; it was the only external wound. X-ray examination showed a ragged shell fragment, about 2 by 3 by 1 cm., at the level of the second sacral vertebra.

The shell fragment was lodged in the distal third of the ileum, and had lacerated two-thirds of the small bowel circumference. The anterior surface, or half the circumference of the rectum, had a ragged laceration about 6 cm. proximal to the reflection of the pelvic peritoneum. The bladder was uninjured.

A lower midline incision was used. The laceration of the ileum was closed

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with a running suture of fine chromic catgut reinforced with interrupted mattress sutures of silk. After removing hard fecal lumps from the pelvic peritoneal cavity, the rectal laceration was closed with difficulty, using mattress sutures of fine chromic catgut. The sigmoid colon was mobilized to permit a loop colostomy without tension. It was suspended over a glass suture container and the wound closed about this loop. The skin was not closed.

The patient made satisfactory progress while aboard ship. On the sixth postoperative day, he had a fever between 100.5° and 101° F. His colostomy had been opened and was functioning. He was tolerating fluids by mouth, and his general condition was good.

Case 8.—This patient, a Marine sergeant, had frank evisceration of about 4 feet of ileum through a ragged wound, 3 cm. in diameter, of the right lower quadrant of the abdomen. A wound less than 1 cm. in diameter was present in the right flank below the twelfth rib. The serosal surfaces of the bowel were covered with volcanic ash. There were three separate perforations of from one-third to one-half the circumference of the bowel in the exposed ileum. None of the bowel was gangrenous. The mesentery was intact. The parietal peritoneum of the cecal fossa was lacerated for several centimeters, but the colon was uninjured. Between the cecum and the right flank wound there was retroperitoneal hemorrhage.

The loops of bowel were carefully washed with normal saline solution and the abdomen was then prepared for laparotomy. The perforations were closed with a running suture of fine chromic catgut reinforced with mattress sutures of silk. A right rectus incision was made. After exploration of the abdomen, the bowel was replaced in the peritoneal cavity. A Penrose drain was placed through the wound in the right lower abdominal quadrant to the retroperitoneal space after the parietal peritoneum had been closed with fine chromic catgut. The incision was closed without drainage.

The patient left the ship in good condition. On the sixth postoperative day he was taking fluids by mouth, but an ileal fistula had developed along the drain in the right lower quadrant of the abdomen.

Case 9.—This Marine private had a wound in the left upper part of the abdomen, and a second wound in the left flank, each less than 1 cm. in diameter. Retroperitoneal hemorrhage extended from the small wound of the parietal peritoneum below the left ribs, into the splenic flexure of the transverse colon. There were paired perforations in the left transverse colon, each approximately 1 cm. in diameter and about 2 cm. from each other. A small serosal abrasion of the proximal ileum was present. The spleen was one and one-half times normal size and was without laceration. The stomach and the root of the mesentery of the small bowel were normal. There was gross fecal contamination.

The abdomen was explored through a long upper left rectus incision. The incision was extended toward the costal margin, across the left rectus muscle, in order to visualize fully the spleen. The abrasion of the ileum was inverted with a mattress suture of silk. The two perforations of the transverse colon were united with scissors. The single laceration thus formed was closed with a running suture of fine chromic catgut placed in two layers. This portion of the colon was suspended over a glass suture container as a loop colostomy, in the upper portion of the incision. The remainder of the incision was closed leaving the skin unsutured. Five hundred cubic centimeters of whole blood and 250 cubic centimeters of plasma were administered during the operation.

While the patient was aboard the ship no pronounced abdominal distention occurred and the temperature did not rise above 101° F. On the sixth post-

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operative day he was taking fluids by mouth and his temperature was subsiding. The laceration of the colon had remained closed.

Case 10.—This patient, also a Marine private, had a small wound in the left midportion of the abdomen, and in the left flank. The abdomen was distended with foul, turbid fluid containing food and fecal particles. There was a laceration of the lateral wall of the descending colon. There was plastic exudate over the serosal surface of the small bowel and omentum. The remainder of the abdomen was not explored because of the peritonitis.

The exploration was done through a lower left rectus incision. The laceration of the descending colon was closed with a chromic suture. The incision was closed with a Penrose drain to the pelvis at the lower portion of the wound.

The patient's generalized peritonitis fulminated until his death, about 20 hours after surgery.

Case 11.—There were several small skin wounds in the lower abdomen in the case of this Marine private, first class. X-ray examination showed numerous small foreign bodies in the area of the lower part of the abdomen.

There was retroperitoneal hemorrhage in both flanks, but there was no perforation of the parietal peritoneum.

The abdomen was explored through a lower midline incision. It was closed in the usual manner.

The patient had an uneventful postoperative course. On the sixth postoperative day he was up and about the ward. His incision had healed per primam.

COMMENT

Certain observations and conclusions have been emphasized by many writers on abdominal war wounds. The remarks made here are drawn from personal experience with casualties at Iwo Jima, Lingayen Gulf, Leyte and Peleliu.

Physical examination is the most reliable method of determining intra-abdominal trauma. Every patient with perforated viscus seen by the author had a rigid, acutely tender abdomen. To a lesser degree those patients with negative findings at laparotomy presented these physical findings because the foreign bodies were actually in the abdominal wall.

Abdominal roentgenograms are of little help in diagnosis because time does not permit accurately calculated localization of foreign bodies. The x-ray film cannot tell the course of the missile nor whether a viscus has been perforated. If there is a wound of entrance in the chest, abdomen, or gluteal region, *without a wound of exit*, the location of the foreign body by x-ray examination may determine whether it has entered the abdomen.

The abdomen must be completely and carefully explored in every laparotomy. In particular, the entire small bowel must be examined. There was no logic to the location or to the number of small bowel perforations. The great mobility of the ileum makes it vulnerable to injury of any part of the abdomen. In case 6 the foreign bodies did not perforate the abdominal cavity, yet there were two areas of sub-

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serosal hemorrhage in the ileum. It is presumed that this trauma was produced by the force of the missiles upon the abdominal wall, which in turn contused the ileum.

Evaluation of gluteal wounds is extremely important. Case 7 clearly demonstrates how gluteal missiles can enter the abdomen. In the Leyte campaign, a similar case was encountered. With a group of from 40 to 50 Army walking patients, a soldier with a gluteal wound came aboard as an ambulatory patient. His wound was over 24 hours old and was not larger than 1½ cm. in diameter. It could have been a superficial wound, or one from which a metal fragment already had been removed. The patient did not know whether a foreign body had been removed. His record indicated only that the wound had been treated. He continued to be ambulant and had no complaints. Twelve hours after coming aboard, he was found collapsed in a passageway in slight abdominal pain. He succumbed rapidly to a generalized peritonitis. Autopsy showed a large perforation in the anterior rectal wall. *Any gluteal wound should be considered an abdominal perforation until this possibility definitely has been excluded.*

Colon perforations, particularly those of the left colon, are attended by a high incidence of generalized peritonitis. The longer a colon perforation exists after 8 hours, the greater is the possibility of a fatal peritonitis no matter what surgical procedure is done. The patient cited in case 10 had been wounded over 24 hours when he came aboard with a generalized peritonitis.

The large amount of intra-abdominal hemorrhage was striking in every case of viscus perforation. In case 9 the hemorrhage was so great that the incision was purposely extended to rule out laceration of the spleen. Incisions should be made in the portion of the abdomen where the greatest damage might reasonably be expected from the probable course and type of missile.

In my experience, all patients with viscus perforations have died of generalized peritonitis if they have been wounded longer than 18 hours by the time they reach the operating table. Treatment relatively soon after injury had much to do with the successful outcome in this series of patients.

The simplest procedures compatible with sound surgical judgment should be employed in the treatment of intra-abdominal trauma. Soldiers in amphibious warfare have little time for eating, and their rations are minimal. Most of them have had no bowel movement for several days prior to the time of injury. Their colons contain extremely hard, inspissated fecal matter. In all colon repairs colostomy should be done at the site of injury, or resection if indicated. Occasionally primary repair of the colon can be done, but preliminary loop

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colostomy should be provided as a safety valve proximal to the site of injury. Obstructive resections of the small bowel are preferable aboard ship or in battle areas. Such procedures permit early evacuation of patients to where secondary closures can be done.

Drop ether is the anesthetic of choice, particularly in the absence of a trained anesthetist. It has little initial shock danger, and can be maintained safely for longer periods of time than other anesthetic agents. Fresh casualties from island warfare have endured ambulance transportation on the beach, and usually a bouncing boat ride by the time they reach a ship for definitive treatment. They are nearly all borderline shock cases, both from their injuries and from their transportation.

The keynote in treatment of battle casualties is speed—speed in diagnosis and speed in surgery. Many wounded soldiers require care almost simultaneously. But omission and carelessness in treatment is not speed. In battle casualties as well as in civilian life, the first surgical procedure determines the length of time for convalescence and the percentage of normal function eventually to be restored. Surgical speed is the accurate application of the simplest surgical principle to a given injury.

SUMMARY AND CONCLUSIONS

1. Ten patients with laparotomies performed aboard ship for acute abdominal perforations by war missiles were put ashore on the third and fourth postoperative days. All of them were making satisfactory progress when seen on the seventh and eighth postoperative days.

2. Seven patients had multiple perforations, which included the duodenum, gallbladder, ileum and colon. Two of these had frank eviscerations when they arrived from the beach.

3. Ether anesthetic, by the drop method, was used in all cases but one.

4. Physical examination was the most dependable method of determining intra-abdominal injury.

5. Complete, careful abdominal explorations were done in every laparotomy.

6. The following methods were used in treating the perforations: Suture, loop colostomy of the injured segment, and obstructive resection.

7. Perforations of the bowel older than 18 hours produce a fatal generalized peritonitis.

8. Gluteal wounds are considered abdominal perforations until definitely excluded by examination or by laparotomy.

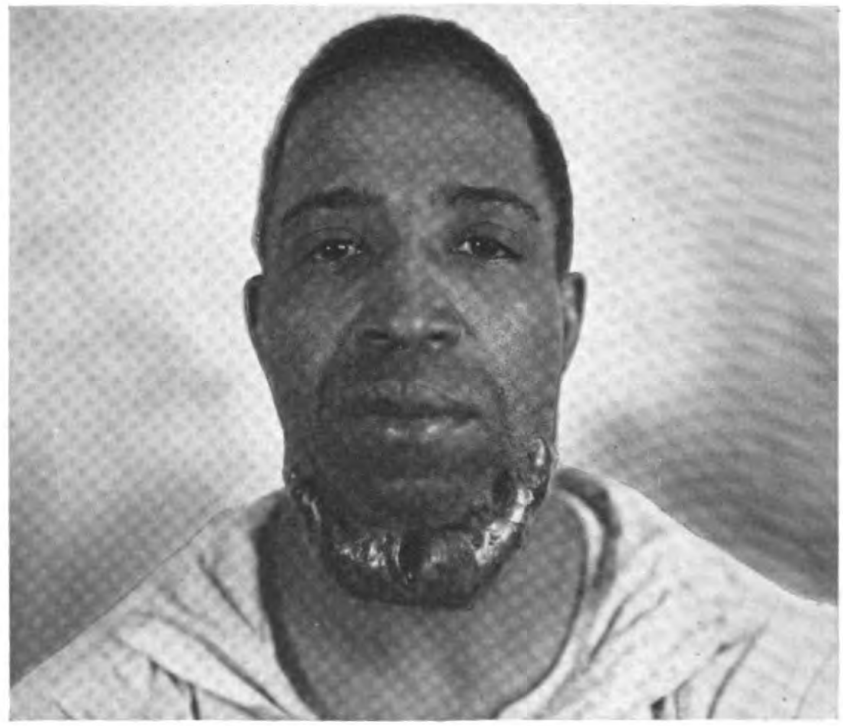
9. Surgical speed is not attained by omitting or by carelessly applying surgical principles.

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CASE OF KELOID

An unusual case of large convex keloid formation involving the entire range of the lower border of the mandible is presented here.



The growth presented the appearance of an irregular, shining tube suspended under the chin. There were innumerable cicatricial bands running from the mass to the normal skin zone, accounting for the irregularity. Here and there, some discrete areas of suppuration interrupted the glazed texture. Palpation revealed the mass to be dense and fibrous, firmly fixed. A peculiar odor emanated from it. No hair follicules could be macroscopically found.

The patient, a colored man, nicked the left side of his face in 1930 while shaving. A small lump the size of a pea soon appeared. Later it became infected and began to exude pus. Five years later the patient had five weekly X-ray treatments, and was told that further treatments would be futile. In 1936 he went to a "cancer doctor," who applied a plaster paste to the mass on the left side of the chin. Eventually the whole chin became involved in this peculiar swelling.

Upon the advice of Navy physicians, the patient has again resumed X-ray treatments daily for 14 days. Surgery was, however, first attempted, when it was discovered that the base of the keloid extended to the deep structures of the mental triangle.—CONNOLLY, JOSEPH P., Commander (MC) U. S. N. R.

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CLINICAL NOTES

HORNER'S SYNDROME FOLLOWING GUNSHOT WOUND OF THE NECK

REPORT OF A CASE

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Horner's syndrome is comparatively uncommon. The following case illustrates the appearance of this syndrome as a sequela of a perforating gunshot wound of the neck.

Case report.—A 21-year-old Marine private was shot in the neck by a Japanese sniper on 23 March 1945. The patient stated that for about a minute after he was shot, the blood "spurted out" of the entrance wound on the anterior aspect of his neck, but that upon lying down the bleeding stopped. There was no hemoptysis and no loss of consciousness. A medical officer administered morphine, and 1 unit of serum albumin concentrate was given intravenously. A dressing was applied and the patient was evacuated to an Army field hospital, where he was given a tetanus toxoid booster and x-ray studies were made. The patient also stated that he was anesthetized and operated upon, but no notation of the results of the x-ray studies or of the alleged operation was found on the hospital records.

The patient was transferred to this ship the following day for evacuation. On admission, physical examination revealed a well-developed white male in no distress. His temperature was 100° F., the pulse rate 80, respirations were 20 per minute, and the blood pressure was 118/78. The entrance wound of the bullet was on the right side of the neck just lateral to the lower border of the thyroid cartilage. The exit wound was situated at the level of the seventh cervical vertebra at the outer border of the right trapezius muscle, about 6 cm. from the midline. Both the entrance and exit wounds appeared clean and were draining a minimal amount of serous material. Around the entrance wound was a small amount of edema, and a slight venous pulsation was noted here but not on the left side of the neck. No operative wound was observed.

On examination of the head, it was observed that the patient presented the manifestations of Horner's syndrome on the right side. The right pupil was smaller than the left, but both reacted well to light and accommodation. There was slight enophthalmos and slight ptosis of the right upper eyelid. Sweating only occurred on the left side of the face.

Examination of the ear, nose, and throat revealed no abnormalities. The glottis was visualized and seen to be regular in outline and to close equally on both sides. Examination of the chest, heart, abdomen, genitalia and extremities showed them to be normal. A neurologic examination showed some weakness in the triceps muscle of the right arm. Subjectively, the patient complained of

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Anterior view showing entrance wound in neck, small right pupil, and ptosis.

some numbness over the right palm, but sensation to pinprick was normal. There were no other abnormal neurologic findings.

Laboratory studies of the urine and blood were within normal limits. A roentgenograph of the cervical spine revealed no bone pathology and showed no foreign bodies.

The patient was placed on a regimen of 6 gm. of sulfathiazole daily for 1 week. A soft diet was prescribed for a few days and then was changed to a regular diet. There was no difficulty in deglutition. Sulfanilamide and vaseline gauze dressings were applied for the first week, after which the wounds stopped draining and dry dressings were instituted. The slight venous pulsation surrounding the entrance wound disappeared entirely after a few days.

The patient's course was uneventful until 10 April, 17 days after admission,

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when he first complained of a throbbing sensation in the neck near the entrance wound. On palpation there was a small area of swelling, about 4 cm. in diameter, just lateral to the entrance wound and situated under the lower third of the sternocleidomastoid muscle. A definite systolic thrill was palpated here. On auscultation a continuous bruit with a systolic accentuation was heard. This was the first time that these signs were noticed, although the patient's neck was examined daily. The opinion held was that this represented the appearance of an aneurysm of one of the smaller arteries in this part of the neck.

On 12 April the patient was transferred to a Naval hospital for further treatment. The Horner's syndrome and the swelling in the anterior neck wound were unchanged. The muscular power of the right triceps muscle was somewhat improved over the condition on admission.

COMMENT

Tumors of the neck, aneurysms, certain birth palsies, or the presence of a cervical rib account for the majority of cases of Horner's syndrome seen in the clinic. One sees in this syndrome a sinking of the eyeball into the orbit (enophthalmos), a constriction of the pupil (miosis), a drooping of the eyelid (ptosis), and an absence of sweating (anhidrosis). These signs occur when the cervical sympathetic pathways are interrupted and are manifested on the same side as the lesion.

Some anatomic and physiologic considerations will serve to explain the symptomatology. The cervical sympathetic nerve chain, roughly speaking, lies on the deep muscles of the neck lateral to the vertebral column. Three ganglia are present in the nerve chain, the superior, middle, and inferior ganglia. The motor supply of the dilatator pupillae muscle of the eye comes from the preganglionic sympathetic fibers which leave the spinal cord with the upper thoracic nerves and pass to the sympathetic trunk. After coursing upward and synapsing in the superior cervical ganglion, the fibers accompany the internal carotid artery, to branch off at the ophthalmic division of the trigeminal nerve, and then proceed through the long ciliary nerves to the dilatator pupillae muscle. The nerve supply to two other involuntary muscles in the orbit follows the same path. These are the muscles which hold the eyeball forward in the orbit, and aid in raising the upper lid.

The vasoconstrictor fibers to the head, as well as the pilomotor fibers to the hair, and the motor fibers to the sweat glands have a similar pathway. These fibers also originate in the lower cervical and upper thoracic spinal cord and pass out to the sympathetic trunk to synapse in the superior cervical ganglion. From here the postganglionic fibers accompany the internal carotid artery and branch to join the sensory branches of the various cranial nerves, especially the trigeminal.

Tonic impulses via the pathways described above maintain an equilibrium with the parasympathetic nerves. When the pre- or postganglionic pathways connected with the upper cervical sympathetic

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chain are interrupted, the equilibrium is upset and the features of Horner's syndrome result.

It may be said that, in this patient, the bullet in traveling through the right side of the neck severed the cervical sympathetic chain, causing the onset of Horner's syndrome. The weakness of the right triceps muscle and the absence of sensory changes were probably due to the partial interruption of the anterior rami of the seventh or eighth cervical nerves by the projectile. The aneurysm, first observed 18 days after the wound was incurred, can be explained most easily as an enlargement due to the trauma inflicted by the bullet. Probably one of the smaller branches of the carotid artery was affected. Certainly the later appearance and position of this aneurysm rule it out as the causative factor of the Horner's syndrome in this patient.

SUMMARY

A case of of Horner's syndrome occurring as a result of a perforating gunshot wound of the neck, has been described.

A discussion of the anatomic and physiologic factors concerned in the etiology of this syndrome has been presented.

The same injury also resulted in a small aneurysm and some motor changes in the right arm.

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DEVELOPMENT OF HEMOLYTIC ANEMIA DURING SULFONAMIDE MEDICATION

Forty-one consecutive patients, receiving sulfa drugs for various infectious conditions, were examined with the purpose of ascertaining the frequency of mild to moderately severe hemolysis.

Sixteen patients showed some degree of hemolysis as manifested by a fall in red cell and hemoglobin values, accompanied by an increase of the reticulocyte count. Rapid spontaneous blood regeneration followed withdrawal of the drug, in most cases during the persistence of symptoms of the underlying disease.

A local suppurative process seems to interfere with blood regeneration after hemolysis.—RACHMILEWITZ, M.; DE VRIES, A.; and HERMONI, D.: Development of hemolytic anemia during sulfa medication. Am. J. Clin. Path. 15: 381–388, September 1945.

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AGGRAVATION OF BACTERIDS BY PENICILLIN

WITH A THEORY AS TO CAUSATION

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Chills and fever "definitely related to the injection of penicillin" have been reported by Keefer and his coworkers (*1*), who further noted that the injection of 10,000 units of penicillin from some lots caused this response, whereas the same method of administration of 5,000 units from the same lot caused no reaction. In a few patients who were afebrile before treatment was begun, low-grade fever, ranging from 100° to 101° F., would occasionally occur, particularly in those patients who were receiving penicillin in large amounts continuously.

Various other reactions have been reported in the literature. Some, consisting of mild subjective symptoms, have been attributed to impurities of the drug, while others, following or occurring late during the course of administration, can be explained on the basis of drug sensitivity. There are still others, however, for which the observers have been unable to advance any logical explanation other than an "atypical sensitization" (*1*) (*2*) (*3*) (*4*).

We have observed patients who exhibited reactions to penicillin as early as a few hours after the initial dose, and some within the first few days, usually when the dosage was increased. These reactions all have been observed in patients giving histories, or displaying cutaneous manifestations of an underlying bacterial allergy. The reactions have consisted of elevation of temperature, with or without chills, leukocytosis, and marked aggravation of existing skin eruptions, frequently associated with the appearance at other sites of new similar cutaneous manifestations.

These eruptions were always of the type which are conceded to be of bacterial allergic origin and have been observed in three cases of nummular eczema, three cases of infectious eczematoid dermatitis, and five cases of recurrent vesicular eruptions of the hands and feet.

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These phenomena are similar to those reported by us (*5*) in the same type of case following ingestion of sulfonamides. Indeed some of our patients who displayed this response to one medication showed the same reaction when the other was administered. Green and his associates (*6*) reported similar reactions with the sulfonamides, and while they offered no explanation, they could not accept them as evidence of true drug sensitivity.

In the case of our sulfonamide reactions, we suggested the possibility that this might be the result of a too rapid liberation of bacterial toxins or other bacterial products, to which the individual was sensitive, from some endogenous focus upsetting the immunologic balance and aggravating the existing bacterids. Our observations with penicillin have so paralleled those on the sulfonamides that they have not only given support to our original hypothesis in regard to the sulfonamides, but also have led us to advance the same explanation for these previously obscure penicillin reactions.

CASE REPORTS

Case 1.—A 35-year-old medical officer was admitted because of a recurrent vesiculopustular eruption of the hands. There was a medical history of chronic urticaria for many years, and there was a family history of asthma and hay fever. The eruption had been present, with frequent exacerbations and remissions, for 3½ years. The present attack had begun as a typical occurrence of vesicles and pustules, and a scaling of the fingers and palms, 3 months before admission. Many forms of local therapy had been used without relief. Sulfonamides by mouth had been beneficial, but penicillin had never been employed.

General physical examination yielded no pertinent findings except for a vesiculopustular eruption between the fingers and on the palms of both hands, with scaling, fissuring, and moderate edema of the fingers. Blood count, urinalysis, and Kahn test results were negative. Repeated leukocyte counts ranged between 6,000 and 7,000 with from 50 to 55 percent neutrophils. Search for fungi by smear and culture failed to reveal their presence on the hands, feet, scalp, or in the groin, or the gastro-intestinal or genito-urinary tracts. Studies for food allergies and vitamin deficiencies showed no abnormalities of this type. Staphylococcus aureus was recovered from the nasopharynx and was cultured from bile recovered by Lyon drainage. Otherwise a thorough search for possible foci of infections was unrevealing. Skin tests showed a moderate reaction to staphylococcus vaccine and fungus extract, but a negative reaction to penicillin.

Intramuscular injections of penicillin were administered, beginning with a 5,000-unit dose and increasing this to 20,000 units administered every 3 hours. When 400,000 units had been given, there was a severe aggravation of all existing skin lesions. The dosage was then increased to 30,000 units every 3 hours, but the existing lesions became progressively severe, and new ones appeared on the forearms, arms, and face, areas which had not previously been involved. The leukocyte count rose to 9,000, with 66 percent neutrophils and 6 percent eosinophils. There was no elevation of temperature, but there was a feeling of malaise. Penicillin was discontinued after the administration of 1,500,000 units.

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Case 2.—A 21-year-old seaman, second class, was admitted with the diagnosis of infectious eczematoid dermatitis. He had chronic sinusitis but there was no personal or family history of allergy. He had been given sulfonamides on several occasions, but he had never had penicillin therapy.

The pustular eruption began 3 years ago on hsi chin, 6 months later pustules appeared in the groin. These persisted in spite of local treatment, including sulfonamides, antiseptics, and x-ray therapy. On admission there were areas of thickened scales and fissuring on the chin, and scaly lichenification over the pubis, extending over the dorsum of the penis. Symmetric areas of small pustules were noted on the sides of the fingers of both hands. General physical examination had otherwise negative results. The leukocyte count was 6,200 with 60 percent neutrophils. Urinalysis and blood Kahn test results were negative, and an intradermal test with penicillin showed no reaction. X-ray examination of the sinuses revealed slight clouding of the left antrum, but search for other foci of infection was unrevealing.

He was started on penicillin in graduated doses, beginning with 5,000 units, but developed a leukocytosis of 11,200, general malaise and a temperature of 99.4° F. when doses of 15,000 units were given. However this dosage was maintained until 600,000 units had been given, at which time the eruptions on the fingers were definitely aggravated, and previously healed lesions on the chin reappeared. Intradermal tests with catarrhal and staphylococcus vaccines were decidedly positive and there was malaise with aggravation of the eruption from these test doses.

Case 3.—A 37-year-old pharmacist's mate, second class, was admitted with a diagnosis of infectious eczematoid dermatitis. Nine years previously he had had a similar eruption confined to the extremities, but otherwise his personal history was free from allergy; however his father had asthma. He had used sulfathiazole ointment on the scrotum 6 weeks previously, but had never been treated in any manner with penicillin.

The present eruption began in December 1944 as grouped patches of weeping papules and vesicles on the arms, thighs, legs, and scrotum. The day before admission he had taken one 0.5-gm. tablet of sulfathiazole on retiring. Itching became severe during the night and the next morning there was an aggravation of all the original lesions, and the appearance of new groups of papules and vesicles on the buttocks and body, and of lesions on the palms, sides of the fingers, and plantar surfaces of the feet. General physical examination yielded otherwise negative findings and no foci of infection could be found by ear, nose and throat, genito-urinary, or dental consultants.

The leukocyte count was 12,700, with 76 percent neutrophils; urinalysis and blood Kahn test results were negative. Microscopic examination of the vesicles on the hands, feet, and scrotum did not disclose any fungi.

The leukocyte count was 7,400 at the time injections of penicillin were started. The patient received two injections of 5,000 units of penicillin at 3-hour intervals, followed by two injections of 10,000 units. After the dosage was increased to 15,000 units every 3 hours for four injections, he developed a temperature of 99.4° F., with an aggravation of the existing eczema and a leukocytosis of seventeen thousand two hundred. Intradermal tests with fungus extract and staphylococcus vaccine were moderately positive, but he failed to react in 48 hours to a similar test with 0.1 cc. of penicillin solution (5,000 units per cubic centimeter) given a week later. At this time his skin was free from papules and vesicles, but there was some residual scaling and pruritus.

These reactions cannot be on the basis of drug sensitivity, because

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in patients not previously exposed, drug reactions do not appear before the sixth day. The reactions observed by us occurred from a few hours to a few days after the initial dose in patients who had never been exposed to this medication, and who had negative skin tests for penicillin. We have been unwilling to explain our observations on the basis of drug toxicity because our cases displayed leukocytosis and neutrophilia, not leukopenia with lymphocytosis as in the drug allergies. Furthermore, as also observed by others (*1*) (*4*), some patients showed reactions on one occasion and not at a later date when the same antibiotic was again administered.

Finally it is impossible to interpret these reactions as being due to drug sensitivity or drug impurities, because not only do they follow sulfonamides, or different stocks of penicillin, but similar reactions have been known to be provoked by an overdose of bacterial vaccine to which the patient is sensitive, and have even been observed following exacerbations of pharyngitis or sinusitis (*7*).

It might be objected that this hypothesis is not tenable because penicillin is bacteriostatic and not bactericidal, but there is sufficient indication that penicillin may also be bactericidal. However, irrespective of its mode of action, in any infection controlled by penicillin or chemotherapy large numbers of bacteria are destroyed by some means, with a consequent liberation of the products of their destruction. It has been suggested that the manifestations which we have observed are a form of Herxheimer reaction, but in a Herxheimer reaction there is always a flare-up of the original focus, with edema and swelling followed by generalized symptoms (*8*). Our cases have shown no aggravation of any possible foci, but only the generalized symptoms described.

SUMMARY

Ten cases of reactions to penicillin have been observed in patients with bacterial allergic dermatoses, of which three typical examples have been reported in detail.

It is our opinion that in many skin eruptions of a bacterial allergic origin, vigorous treatment with penicillin or sulfonamides may cause temporary acute exacerbations accompanied by systemic reactions due to the rapid liberation of toxins from the focus. Penicillin or sulfonamides must be used in small, gradually increasing doses to avoid such reactions and to prevent exacerbation of existing lesions.

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SULFONAMIDES IN TREATMENT OF MADURA FOOT

Every case of actinomyces Madura foot should be treated with doses of sulfonamides, sufficient to produce blood levels of about 8 mg. percent, during at least three weeks, and, if necessary, with repeated courses of this therapy. Advice to amputate the member should never be given before this is seriously tried. Because of the great similarity of the clinical picture of the cases of Madura foot caused by actinomyces and those caused by true fungi, the benefit of a trial with all the precautions mentioned above should be given to every patient suffering from Madura foot.—PETERS, J. T.: Clinical cure of Madura foot. Am. J. Trop. Med. 25: 363–365, July 1945.

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ARTIFICIAL PNEUMOTHORAX

The perfect AP is one which brings full relaxation and immobilization to the diseased zones of a lung. Full relaxation and immobilization of any diseased zone in the lung is only possible when the healthy areas are given enough breathing space to cope with the entire tidal flow. An AP is a dynamic condition whose efficacy cannot be gaged by an x-ray snapshot in full inspiration. A better impression can be gained by screen examination of the respiratory cycle; but the final assessment must always be on clinical progress. It is possible to discuss AP therapy without (mis)using the word "collapse."—DAY, G.: The "perfect AP." Lancet 2: 300–301, September 8, 1945.

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ISCHEMIC MUSCLE DAMAGE

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During the last 4 years, numerous papers on the "crush" or "compression syndrome" have been published. In 1941 Bywaters and Beall (*1*) called attention to the syndrome, after no clinical descriptions of it had appeared in the literature since Frankenthal's (*2*) description in 1916. Recently Bywaters (*3*) has ably summarized the literature on the subject and readers are referred to that paper for a complete review.

Briefly the syndrome as described by Bywaters et al. (*1*) (*3*) (*5*) (*6*), involves burial beneath debris, or compression of a limb, for from 2 to 4 hours. Often the patient is in good condition at first but develops shock within a few hours after removal from the compressing material. In spite of supportive antishock therapy, the patients often develop progressive renal failure. About one-third of the patients recover, but the others die in uremia within a week following injury. Bywaters and Stead (*4*) have obtained some experimental evidence that the renal failure is caused by the toxic effect of myohemoglobin absorbed from the damaged muscle. It is generally conceded that ischemia is the fundamental cause of the muscle damage.

The seriousness and frequency of this syndrome was emphasized in those countries under air-raid attack, where the mechanism of injury was all too often repeated.

Isolated similar injury mechanisms must be commonly experienced but remain unrecognized in industrial and automobile accidents. The following report illustrates a case of muscle damage sustained in an automobile accident. Pathologically it is believed to be the type of injury described as ischemic muscle necrosis by the British authors.

Case report.—The patient, a 36-year-old white seaman, was one of four occupants of an automobile which was struck by a railroad train. The other three occupants were killed outright. The patient was hurled through the windshield and was found lying on top of the radiator hood. No mention is made of compression of a limb. He was removed (definite time interval not known) to a nearby small civilian hospital where emergency shock treatment with infusions and transfusions was immediately instituted. Diagnosis of cerebral concussion, fracture of ribs 4 and 5 on the right, perforation of lung, subcutaneous emphysema, and simple comminuted fracture of both bones in the upper third of the right lower leg was made.

Because of shock and the poor condition of the patient, no attempt at reduction of the fractured leg was made until the third day following the accident.

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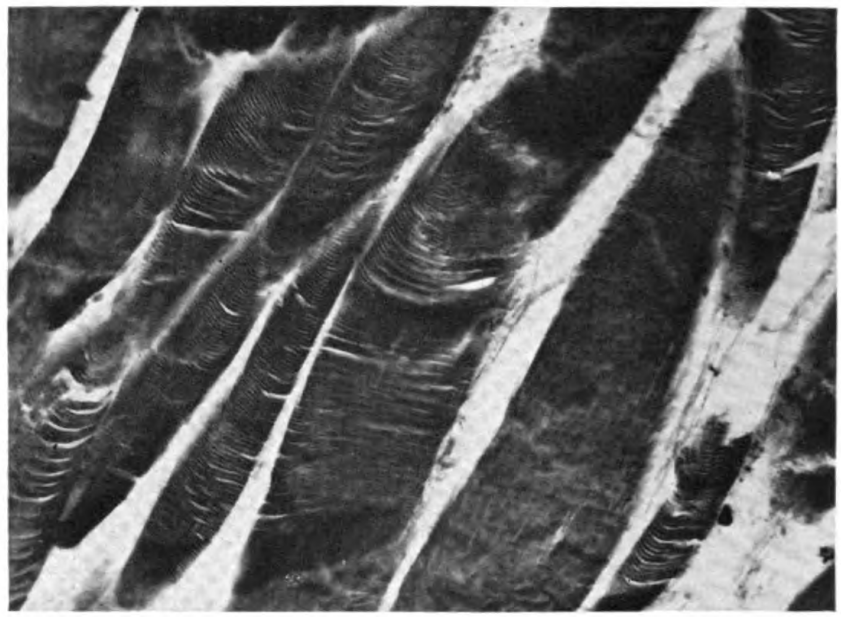
1. Muscle biopsy taken 3 months after injury. Note the accentuated cross striations, absence of longitudinal striations, and absence of nuclei. Hematoidin crystals, abundant elsewhere in the section, are by chance absent in this portion. × 200. (Hematoxylin and eosin.)

At that time, os calcis pin traction was applied. He was seen by Navy consultants who thought his condition too serious to permit removal to the nearest Naval hospital about 30 miles away. On the fourth day his coma partially abated. By the tenth day he was much more responsive and it was considered safe to remove him to a Naval hospital.

On arrival it was noted that the right leg was tensely swollen, as it had been from the time of the accident, and that the dorsalis pedis pulse on the right was not palpable. X-ray and clinical diagnoses confirmed those made in the civilian hospital. A neurologic consultant diagnosed paralysis of all nerves of the right lower leg except the sural. The patient continued to improve, but was not entirely clear mentally until 6 weeks after the accident. Meanwhile the swelling of the right leg had subsided and x-ray examination showed beginning callus formation at the site of the fibular fracture but none in the tibia. The fragments seemed well alined, and a circular cast with good foot support was applied.

Four months following the injury there was still nonunion of the fracture of the tibia, so open reduction was attempted. The most striking feature found at operation was the appearance of the muscle in the anterior tibial sheath. This muscle was a dull mustard yellow color with visibly granular coarse fibers. Bleeding on cutting the muscle was minimal. On palpation, excised portions of muscle seemed to have increased friability, yet were readily recognized as bits of flesh. Muscles other than those enclosed within the anterior tibial sheath appeared normal except for some over-all atrophy. Interposed fibrous tissue was removed, the bone fragments were alined, and the wound was closed. The patient recovered promptly but the fracture still did not heal.

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2. Muscle biopsy taken 7 months after injury. The picture is similar to that seen in figure 1. The black roughly circular splotches are clumps of hematoidin crystals. The large fiber without transverse striations is one of the few of its kind seen. Under the microscope it appears homogeneous and deeper-staining than the neighboring fibers. × 200. (Hematoxylin and eosin.)

Three months later, 7 months after the accident, a second open reduction was attempted. Muscle in the anterior tibial sheath had the identical appearance described at the first operation. Interposed tissue was removed, the bone fragments were alined and the wound was closed. The wound became infected but the patient responded to local and intramuscular injections of penicillin, and now, 2 months after the second open reduction, the patient is up and about on crutches. Beginning callus formation is present at the site of the tibial fracture.

The patient has never complained of urinary symptoms nor has he shown signs of uremia. On admission, 10 days following the accident, the blood nonprotein nitrogen was 33 mg. percent, the urine was normal, and the blood count indicated a moderate normocytic anemia. Four and again 6 months following the accident, the blood nonprotein nitrogen rose to 37.5 mg. percent, but since then it has remained in the low thirties. The urine has remained normal and the blood count has returned to normal.

Figures 1 and 2 illustrate the microscopic picture of muscle biopsies taken at the first and second operations respectively. Essentially the histology is the same, although the biopsies were taken 3 months apart, or at 4 and 7 months respectively after the original injury. Muscle nuclei have disappeared. Transverse striations are accentuated and coarse, but longitudinal striations have disappeared. The tissue absorbs stain poorly and unevenly. There is a slight increase in fibrous tissue around some of the blood vessels, but there is no evidence of generalized fibrosis. Blood vessels are patent. Edema and cellular inflammatory reaction are absent. What shows in the photographs as circular black splotches, microscopically consists of brilliant, refractile, brownish-yellow clumps of crystalline hematoidin. Some areas, particularly in the vicinity of blood vessels, contain more of this pigment than other areas.

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COMMENT

The typical pattern of Volkmann's ischemia of muscle involves decreased blood supply to a part, muscle death, inflammatory reaction, and fibrosis with contracture (*7*) (*8*) (*9*). The fibrosis is widespread through the involved area and is accomplished within 2 to 3 weeks. The histology of compressed muscle within 1 or 2 weeks after injury is varied, but according to Bywaters (*3*) one form is similar to that described above. In the case presented, the blood supply is decreased and the muscle is damaged, but after 7 months there is no inflammation, no liquefaction, no fibrosis, and no calcification. The tissue has remained apparently in status quo, discounting general atrophy of disuse, for at least 3 months.

It is difficult to accept the term necrosis for this condition, yet no appropriate substitute comes to mind. Knowledge of the end result of the disease would help. Albert and Mitchell (*7*) report 3 cases, including one of a gunshot wound of the thigh, necessitating ligation of femoral artery and vein, and one crush injury to the thigh. These patients carried on for more than 20 years before additional medical interference was necessary. Fibrosis of the anterior tibial muscle group was found at that time in both cases. Presumably this represents the end stage of the disease "ischemic muscle necrosis." Further biopsies in the case herein reported are planned, although the local postoperative wound infection has probably considerably altered the tissue. Certainly this case is not unique. It is hoped that others will present their findings at various stages of the disease so that a definitive pathologic trend may be formulated.

SUMMARY

1. A case of ischemic muscle damage following an automobile accident with injury to a leg has been presented.

2. The gross and microscopic pathology of the involved muscle at 4 and 7 months after injury has been presented.

3. The similarity of this pathologic picture and the "ischemic muscle necrosis" described by the British authors has been outlined.

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TREATMENT OF ULCER WITH PROTEIN HYDROLYSATE

A hyperalimentation treatment with a high caloric and high amino acid (protein hydrolysate) mixture has been found to be efficacious in promptly bringing acute peptic ulcers to a state of quiescence. It is also a prompt method of simultaneously rehabilitating the strength and body weight of the ulcer patient. The prompt improvement appears to be due to the giving of a substance (protein hydrolysate) that is simultaneously an antacid and an easily assimilable food which can be built into tissues.

The treatment does not insure against recurrence when the patient reverts to old dietary habits. A protein deficiency has been demonstrated in a large percentage of peptic ulcer cases.—TUI, C.; WRIGHT, A. M.; MULHOLLAND, J. H.; GALVIN, T.; BARCHAM, I.; and GERST, G. R.: Hyperalimentation treatment of peptic ulcer with amino acids (protein hydrolysate) and dextri-maltose. Gastroenterology 5: 5–17, July 1945.

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STREPTOMYCIN IN TUBERCULOSIS

The most interesting of all applications of streptomycin is its possible use against tuberculosis. It inhibits the growth of tubercle bacilli in vitro. Feldman and Hinshaw have described a trial in which guinea pigs were inoculated with virulent tubercle bacilli and treated with streptomycin in doses up to 6,000 units daily for 60 days. At the end of this time there was widespread tuberculosis in untreated control animals, while in the treated animals it was hardly detectable microscopically; viable bacilli, however, were usually still present.—New antibiotics. Roy. Canad. Nav. Med. News Letter 2: 1–5, July 1, 1945.

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MENINGOCOCCIC MENINGITIS WITH SEVERE CEREBRAL INVOLVEMENT

RECOVERY WITH PENICILLIN AND SULFADIAZINE REPORT OF A CASE

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and
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A case is reported of a meningococcic infection with severe bilateral cerebral involvement, which was treated successfully with penicillin and sulfadiazine combined. Specific treatment was not started until after paralysis had occurred in the right upper and in both lower extremities and the patient was in a deep restless stupor. Penicillin was administered intramuscularly, intrathecally and intraventricularly. Localized abscess formation was excluded on the eighth day by ventriculography.

Case report.—A 19-year-old male torpedoman's mate, second class, was transferred to the U. S. Naval Hospital, Oakland, California, on the night of 27 August 1944 with no established diagnosis. The original admission for chills and fever had been made on 22 August. A spinal puncture had been performed on the same day, with Pandy negative, pressure normal, and cell count 2 lymphocytes per cubic millimeter. He was placed on atabrine although the malarial smear was negative, presumably because of a previous history of recurrent malaria. He became progressively worse and on the day of transfer was stuporous, disoriented, and incontinent.

Upon admission the patient was in a restless stupor. He grimaced and groaned during the examination, but was unable to speak. Rectal temperature was 103° F., with pulse 118 and respirations forty. The skin was yellow-tinted and dehydrated, but he showed no rash. Voluntary movement was limited to the head and left upper extremity. A gross, coarse, oscillatory tremor and severe ataxia and weakness were apparent in movements of the left arm. The eyes were opened readily, and grimacing on painful testing was symmetric. There was divergent squint and a vacant stare. Ophthalmoscopic examination revealed only fullness of both optic disks.

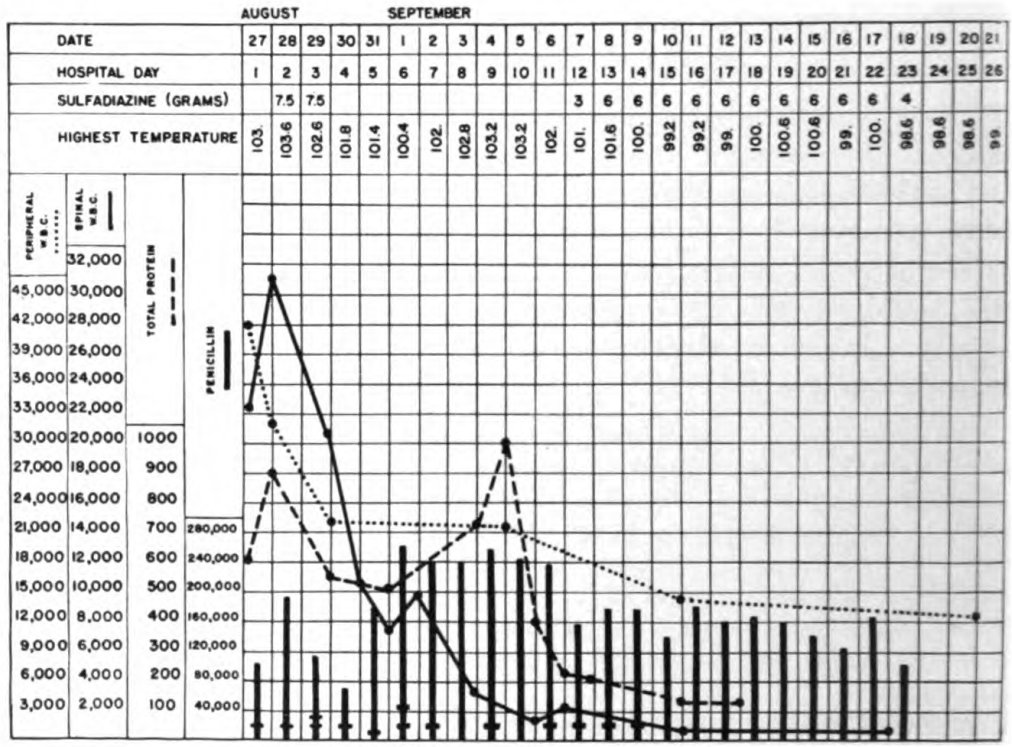
The neck was retracted, but the rigidity could be overcome, with firm pressure, almost to complete flexion. This maneuver appeared to cause severe pain. Positive Brudzinski and Kernig signs were present. Muscle tone was variable. The tendon reflexes were present throughout, but the superficial reflexes were absent. Bilateral positive Babinski and Hoffmann signs were elicited.

The blood count revealed 42,500 white blood cells, 95 percent of which were polymorphonuclear neutrophils. Urinalysis was negative. Lumbar spinal fluid pressure was 150 mm. of water, with a prompt rise on transient jugular compression. The fluid was opaque with a brownish tinge. There were 25,000 white blood

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cells, 97 percent of which were neutrophils. Numerous intra- and extracellular gram-negative diplococci were demonstrated by direct smear, but no growth appeared in culture of the fluid taken before treatment was instituted.

Treatment with 20,000 Oxford units of penicillin in 10 cc. of normal saline intraspinally was followed immediately by administration of 80,000 units intravenously and 20,000 units intramuscularly at two-hour intervals. Five grams of sodium sulfadiazine was given intravenously at intervals of about eight hours for two days. A second 20,000 units of penicillin was administered intraspinally 12 hours after the first. The subsequent daily administration of penicillin and sulfadiazine is shown in the accompanying graph.



Graphic representation of daily drug administration and laboratory findings. **A.** Vertical lines represent penicillin administration, each block corresponding to 40,000 Oxford units. The crossmarks represent intrathecal and intraventricular administration. **B.** Dashed line represents the total protein of the cerebrospinal fluid obtained by lumbar puncture. One block represents 100 mg. percent. **C.** Continuous line represents the spinal fluid white cell count. One block represents 2,000 cells. **D.** Dotted line represents the total white cell count of the peripheral blood. One block represents 3,000 cells. **E.** Highest daily temperatures and total daily sulfadiazine dosages are recorded at the top of the graph.

On 29 August, the third day of treatment, there was little clinical evidence of improvement. It was suspected that thrombophlebitis of the cerebral veins and superior sagittal sinus was the cause of the paralysis and unfavorable course. However, the possibility of loculation of fluid, or abscess formation, prompted an exploratory trephine opening in the left posterior parietal region. The cortex appeared pale with no superficial exudate upon it. No large vessels

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were exposed. Cloudy ventricular fluid was obtained at a normal depth. The cell count on the ventricular fluid was 1,716 leukocytes and total protein 100 mg. percent. Penicillin, 15,000 units in 10 cc. of normal saline, was introduced into the ventricle following drainage. On 1 September 20,000 units were given intraventricularly because very little improvement was evident.

Although there was slight improvement in the left arm movements, slight improvement in response, and reports of upper extremity movements in the next two days, examination on 4 September indicated a relapse. The stupor was deeper and voluntary movements were only obtained in the left arm. For this reason ventriculography with oxygen (20 cc.) was performed (through the trephine opening already present) to exclude brain abscess. The ventricular system was adequately demonstrated by roentgenograms and no deformity was observed.

Because of the minimal improvement after 12 days of penicillin treatment, sulfadiazine was again administered on 7 September. More marked improvement occurred in the next two weeks, first in both left extremities and then in the right upper extremity.

On 11 September the patient was much better oriented and two days later movements were made with both arms. Thrombophlebitis of the right saphenous vein complicated the clinical picture on 12 September, but this subsided in five days. On 29 September the patient was quite alert and cooperative although he seemed mentally retarded. Both lower extremities were moved well. The left upper extremity was moved well, but both right extremities were moderately spastic. Examination on 11 November revealed a total deep peroneal palsy on the left which was greatly improved on 15 February 1945 when he was again examined. At that time there was mild spastic right hemiparesis with good coordination. Slight flexion contracture of the right elbow was present. No signs of active infection have been seen since specific treatment was discontinued. Rorschach and Wechsler-Bellevue examinations of 4 November 1944 revealed evidence of slight intellectual impairment. The patient is now (20 February 1945) well except for slight flexion deformity of the right elbow.

SUMMARY AND CONCLUSIONS

1. A patient with advanced neurologic findings which resulted from central nervous system infection by the meningococcus was successfully treated with penicillin and sulfadiazine.

2. The causative agent was established beyond a reasonable doubt as the meningococcus by the identification of gram-negative intracellular diplococci in the spinal fluid even though the culture was reported negative.

3. The spinal administration of penicillin is considered an important part of the treatment of this patient, although as many as 12 intraspinal injections may not have been necessary.

4. Trephine exploration, intraventricular penicillin administration, and ventriculography were, in retrospect, not essential. However, the diagnostic procedures excluded surgical complications and clarified the course as far as therapy was concerned. There was no evidence that these procedures harmed the patient in the least.

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MALIGNANT GRANULOCYTOPENIA TREATED WITH PENICILLIN

REPORT OF A CASE

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The use of penicillin in the treatment of malignant granulocytopenia is still in the early stages. Few cases have been reported in detail. Smith, Cohen, and Nichols[1] reported two cases in which penicillin was considered to have been responsible for cure of the disease. Two cases were reported in the November 1944 issue of this BULLETIN. At this time it appears worth while to emphasize the rationale behind this latest and most reasonable trend in the treatment of this frequently fatal disease.

Dameshek and Wolfson[2] were among the first to recognize that death in agranulocytosis is due not to the deficiency of neutrophils per se, but to an overwhelming sepsis in a body deprived of the defenses afforded by the neutrophils. They reported two cases with recovery in which sulfathiazole was used in large doses, and noted that its action was independent of the absence of neutrophils. In the treatment of three cases which developed during sulfadiazine therapy, Nixon, Eckert, and Holmes[3] continued to give their patients large doses of sulfadiazine, with recovery in each case. They emphasized that the chemotherapeutic action of the sulfonamides is independent of the granulocytes; that it is effective in patients with leukopenia or agranulocytosis; and that prevention or control of the sepsis is the most important feature in the successful treatment of the disease. Although their patients received additional therapy, including liver extract and pentose nucleotide, Smith, Cohen, and Nichols observed remarkable improvement during the first 24 hours of penicillin therapy.

The essential feature in the pathology of agranulocytosis is a maturation arrest of the granulocytic elements of the bone marrow.

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Therefore prevention or control of the resulting sepsis with a chemotherapeutic agent until normal leukopoesis re-establishes itself is a rational approach to the treatment of the disease.

Case report.—The patient was a 35-year-old aviation chief machinist's mate. On 21 December 1944 he noted a white spot on the anterior border of the tongue and later that day developed an "upset stomach." The following day he noted spreading of the white spot on the tongue, redness around it and swelling of the submaxillary lymph nodes. On 23 December he awakened with a swollen painful tongue and sore throat, and experienced difficulty in swallowing. When he drank cold water, for which he yearned, he developed chilly sensations.

On the following day he reported to the sickbay and was referred to the dental officer for treatment. Silver nitrate was applied to the affected area on the tongue and to another area on the mucous membrane of the right cheek. That night he experienced great difficulty in sleeping because of a severe sore throat, painful swelling, and dryness of the tongue, chilly sensations, and sweating. The next day the ulcers had become larger, the tongue more swollen, reddened and painful, and he developed symptoms of a systemic reaction, with shaking chills, fever, and malaise. However he was on liberty and remained at home.

On 26 December a diffuse, dirty white membrane covered the gums, and he noted several more small ulcers in the oral cavity. He reported to the sickbay and was again referred to the dental officer who put him to bed and treated him with penicillin for a Vincent's infection of the mouth. At this time he was acutely ill with a temperature of 103° F. and he developed a chill which lasted 1 hour. Later he was seen by a medical officer who made a diagnosis of scarlet fever, isolated the patient and instituted sulfonamide therapy.

On the following day a blood count showed the total leukocytes to be 2,050, with 2 band forms, 88 lymphocytes, and 10 monocytes. The diagnosis was changed to granulocytopenia, malignant, and penicillin was continued, 20,000 units every 3 hours, for the next 2 days. The patient's condition did not improve, however; there were brief periods when he became irrational, and he was transferred to this hospital. Prior to admission, he had received 200,000 units of penicillin and 13 gm. of sulfathiazole.

He was admitted on 29 December, at which time physical examination revealed an acutely ill white male who appeared quite confused. The temperature was 104° F., the pulse rate 112, and the respirations were 25 per minute. The skin was hot, dry, and diffusely red. The gums were covered with a white-to-gray membrane and there were several dirty gray, necrotic ulcers in the oral cavity. One, 3 by 6 cm., was on the anterior portion of the tongue which was quite swollen and red. The pharynx was moderately injected but presented no ulcerated areas. The left anterior cervical lymph nodes were somewhat enlarged. The heart and lungs were normal. The bladder was quite distended but there were no other remarkable findings.

The blood count on admission showed 3,750,000 erythrocytes, and 2,300 leukocytes, with no neutrophils, 96 lymphocytes, and 4 monocytes. The patient was unable to void, but a catheterized urine specimen was normal. A blood specimen taken at this time was later reported negative for bacterial growth. The patient was given 50,000 Oxford units of penicillin in 1,000 cc. of 5-percent dextrose solution intravenously, the flow being regulated so that he received approximately 10,000 units per hour. Concurrently he was given 10 cc. of pentose nucleotide and 20 units of liver extract. After the infusion was completed, 500 cc. of citrated whole blood was administered. Penicillin was again administered, 50,000 Oxford

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TABLE 1.—*Blood counts during hospital stay*

Date	WBC	Neutrophils	Band forms	Lymphocytes	Monocytes	Premyelocytes	RBC	Hb. (percent)
12/29	2,300	0	0	96	4	0	3.75	81.0
12/30	1,300	4	1	89	4	2		81.2
12/31	2,700	12	25	62		1		87.6
1/1	4,950	24	22	54				87.6
1/2	9,350							95.0
1/3	7,800						4.25	
1/4	8,900	43	8	47	2			87.0
1/6	4,500	67		33			4.75	100.0
1/9	4,100	57	8	34	1			88.0
1/10	7,900	69	2	29				84.0
1/12	4,550	69	4	27				88.0
1/13	5,450							81.0

TABLE 2.—*Treatment administered*

Date	Penicillin (units)	Pentose nucleotide (cc.)	Yellow bone marrow extract (capsules)	Liver extract (units)	Whole blood (cc.)
12/29	50,000	10		20	
12/30	110,000	40	4		750
12/31	120,000	40	8		
1/1	125,000	20	8		
1/2	120,000	20	8		
1/3	60,000	10	8		
1/4	60,000		8		
1/5	15,000				

units in 1,000 cc. of 5-percent dextrose solution intravenously, and was then continued in doses of 10,000 Oxford units intramuscularly every 2 hours.

During the first 24 hours the patient's condition remained critical and he continued to be in a confused state. At 1600 of 30 December, about 20 hours after admission, he developed a severe chill after the administration of 250 cc. of citrated whole blood, and by 1700 his temperature rose to 106° F. At 2100, approximately 26 hours after admission, his temperature was 97.6° F., he was sweating profusely, and stated that he felt somewhat better. On 31 December, the second hospital day, he was much improved; his temperature varied between 98.6° and 100° F., and the large necrotic area on his tongue sloughed, leaving a deep ulcer with a clean base. He continued to improve and his temperature thereafter remained normal. By 6 January, the ninth hospital day, he was up and about, and the ulcers of the tongue and oral cavity were healed. On 20 January he was discharged.

After he was discharged, the patient admitted to his base medical officer that he had treated himself for gonorrhea and that he had taken 2 gm. of sulfathiazole for 20 days prior to the onset of his illness.

COMMENT

The blood counts in this case are given in table 1. On the morning after admission a platelet count was 192,000. The bleeding time and clot retraction time were normal. A sternal puncture done about 12 hours after admission revealed a maturation arrest of the granulocytic elements, with no mature cells but a rare band neutrophil, and a relative increase of the myeloblasts, although the total number of

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white blood cells was considered decreased. A second sternal puncture done 9 days after admission revealed normal bone marrow.

Treatment administered at this hospital is given in table 2. Although this patient received additional therapy, including pentnucleotide, yellow bone marrow extract, liver extract, and whole blood, the dramatic improvement was noted during the first 48 hours of hospitalization and after he had received large doses of penicillin. Only relatively small amounts of the other drugs were administered during this time. The possibility that the reaction to the second transfusion was beneficial must be considered, especially as his improvement apparently followed it. However it may very likely have been coincidental.

This case lends support to the theory that prevention or control of the overwhelming complicating sepsis by a chemotherapeutic agent is the most rational treatment of malignant granulocytopenia. Penicillin is the safest and best therapeutic weapon available at present, because penicillin itself is not capable of producing the disease.

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PENICILLIN TOPICALLY IN CHRONIC ULCERS

The secondary infection in chronic stasis ulcers responds readily to topical applications of penicillin. It is thought to be superior to other bacteriostatic agents that are generally used for this purpose. In the early stages rapid healing occurs when the infection and stasis are controlled. Healing is delayed in the cases of chronic ulceration because of extensive fibrosis of the edges and poor arterial blood supply.—LOVELL, D. L.: Penicillin; its topical use as bacteriostatic agent for palliative treatment of chronic stasis ulcers of lower extremities. Arch. Surg. 51: 22–27, July–August, 1945.

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CHRONIC STASIS ULCERS OF LEG

The local infection in all cases subsided rapidly after the application of penicillin. Penicillin appeared to be far superior to other bacteriostatic agents in cases in which there had been previous treatment. The infection was controlled more readily when the dressings were changed twice each week.—LOVELL, D. L.: Penicillin; its topical use as bacteriostatic agent for palliative treatment of chronic stasis ulcers of lower extremities. Arch. Surg. 51: 22–27, July–August 1945.

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PLASTIC RECONSTRUCTION OF LIP FOLLOWING GUNSHOT WOUND

REPORT OF A CASE

JACK V. CHAMBERS
Commander (MC) U.S.N.R.

Probably there is no field of surgery in which the restoration of a part to normal, or as nearly normal as possible is as highly selected and in which the end results are as obvious as in the field of plastic surgery. With our newer drugs, our system of rapid evacuation from front lines to base hospitals, either abroad or at home, and with men better trained in plastic repair, the worst type of mutilation can be given some semblance of the normal, at least enough so that the patients do not become outcasts. The following case is an example.

Case report.—The patient, a 21-year-old Marine, was hit in the mouth by an enemy bullet, causing extensive injury to the soft tissues of the jaws, lip, and tongue, and a severe compound comminuted fracture of the mandible with loss of the following teeth: Numbers 20, 21, 22, 23, 24, 25 and 26.

He was placed in a field hospital and given treatment for shock and a debridement was done. A booster of tetanus toxoid was given and sulfonamide dressings were applied. Nine days later, at a base hospital, his condition had improved to such an extent that it was possible to carry out further debridement, and the fragments of the mandible were fixed with a Roger Anderson splint. There was considerable infection during the early phases and osteomyelitis of the mandible developed.

After 6 weeks the Roger Anderson splint was removed, at which time the fragments were held in fair alinement by fibrous union, but infection was still present. Three months after the initial injury the patient's condition was such that he was able to be transferred back to a hospital in the United States.

On arrival at this hospital x-ray examination of the mandible revealed beginning bony union and osteomyelitis was present. There was a draining sinus, both in the mouth and beneath the mandible on the right side exteriorly. Numerous shell fragments were demonstrated around the jaw and neck.

The tongue had completely healed, and all edema and infection of the lip had subsided, leaving a jagged V-shaped opening in the middle and completely through the lower lip, extending to the mentum. The right corner of the lip had a jagged, oblique scar with resulting lowering of the lip and destruction of the vermilion border and angle of the mouth.

Two months after arrival at this hospital (6 months after the initial injury) the osteomyelitis had subsided and the first of a series of operations was done in reconstruction of the lips and jaw.

An open reduction was done through an incision below the mandibular ridge on the right side. Malunion with a fibrous and bony bridge was found. An osteotomy was done, with reposition of fragments and proper occlusion of the

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Photograph taken 9 days after enemy bullet hit patient in mouth, and photograph taken 8 months after injury and after plastic restoration of lips and mandible. Present scars are to be removed at a later date.

teeth. Fragments were held with a vitallium plate and screws. A Winter arch bar with elastic traction was used to obtain occlusion. Three weeks later the elastic traction was removed and the articulation of the upper and lower teeth was satisfactory. Two months later the vitallium plate and screws were removed. Good alinement and bony union had taken place.

Two weeks after the removal of the vitallium plate the first plastic repair was done on the lip, with removal of the scar tissue in the center defect, bringing the fibers of the orbicularis oris into apposition and holding them with through-and-through black silk sutures. The vermilion edges of the defect were approximated. The scar in the corner of the mouth was removed at the same operation and a new vermilion border constructed.

Three succeeding plastic operations at intervals of 3 and 4 weeks were necessary to construct a lip resembling normal. These operations were not attempted until acrylic partial dentures with cast clasps had been constructed to give a normal contour to the mouth as an outline in repair of the lip.

There still remains a scar from the vermilion border in the center and corner of the mouth, extending down the chin about 1½ centimeters. No attempt will be made to remove these scars for at least 6 or 8 months, preferably longer.

COMMENT

Plastic restoration of facial features mutilated by gunfire often restores the psychic equilibrium in an individual. In the case described here the patient refused to go on liberty prior to plastic repair of his lip. During the first few months in the hospital he would

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leave the confines of his ward only in case of necessity, but now feels free to move about in public.

Frequently other trained specialists work with the plastic surgeon. In this case both the orthopedic and dental surgeons worked together to reconstruct the mandible and do the prosthesis necessary.

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RED CELL AGGLUTINATION IN PNEUMONITIS

The red cell agglutinating agent present in the lungs of mice infected with pneumonitis virus has been subjected to study. Maximum agglutination develops after heating the fresh lung extract at 75° C. for 5 minutes. The agent is absorbed from active extracts by preparations of mouse red cells and of fresh normal mouse lungs. Mice injected with the heated agent develop active immunity against the living virus and their sera have the capacity of inhibiting red cell agglutination. The sera of rabbits immunized against living pneumonitis virus or against active heated mouse lung extract inhibited red cell agglutination. Hamsters appear to be susceptible to infection with the pneumonitis virus but attempts at continued serial passage were unsuccessful. The agglutinating agent has been purified by precipitation with ammonium sulfate. The purified agent retains its agglutinating and immunizing capacity.—MILLS, K. C., and DOCHEZ, A. R.: Further observations on red cell agglutinating agent present in lungs of virus-infected mice. Proc. Soc. Exper. Biol. & Med. 60: 141–143, October 1945.

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STILBESTROL IN PROSTATIC CARCINOMA

Neither stilbestrol nor castration represent a cure of prostatic carcinoma. After 4 years of their use by a large number of urologists, with variable results and opinions, only one result seems agreed upon. Neutralization by stilbestrol or castration does improve a majority of patients and does permit them to live at least much more comfortably if not longer. For want of anything better, therefore, it should be used on every patient with carcinoma of the prostate gland.—PIERSON, L. E.: Treatment of carcinoma of prostate gland. J. Iowa M. Soc. 35: 357–359, September 1945.

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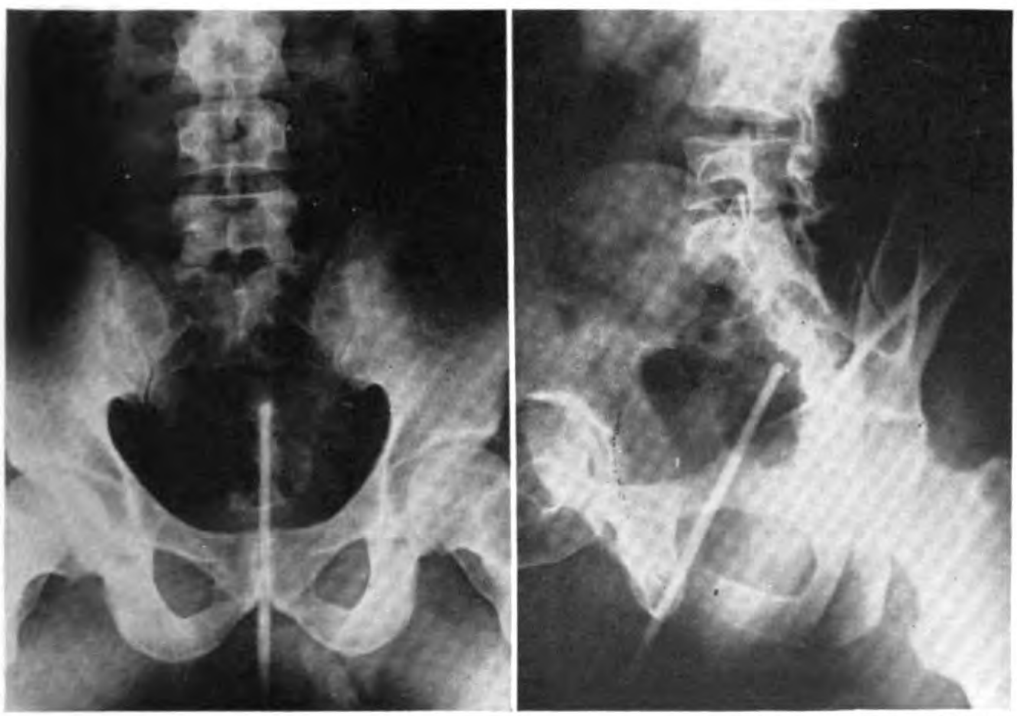
GLASS STIRRING ROD IN URETHRA AND BLADDER

A CASE REPORT

HAMDEN C. MOODY
Captain (MC) U.S.N.R.
and
MYRON H. NOURSE
Lieutenant Commander (MC) U.S.N.

Foreign bodies in the male urethra are not uncommon. The literature lists items and articles of such variety and bizarre nature as to be almost incredible. Such things include crochet hooks, glass marbles, four-pronged fork, thermometers, pencils, and hairpins. This is not the initial instance in which a glass stirring rod has been found in the urethra; however because of its relative infrequency and unusual circumstances, it warrants mention.

Case report.—A seaman, first class, 35 years of age, was admitted with the complaint of inability to "pass water" and "pain in the rectum." On the previous evening, during a rather severe drinking bout, he attempted intercourse, and



—*Official U. S. Navy Photos.*

Anteroposterior and oblique views of glass stirring rod in urethra and bladder.

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possibly because of unsatisfactory erection, the girl "inserted something" into his penis. He returned to quarters and during the early morning found he was unable to urinate. He reported to the sickbay and was admitted to this hospital.

Physical examination revealed a well-developed, well-nourished white male who was not acutely ill. The temperature was 99.8° F. There was a bulge in the perineum, painful to pressure. The bladder was palpable 3 fingers above the symphysis. There were no lacerations about the penis and rectal findings were negative. Anteroposterior and lateral roentgenograms of the pelvis are shown. The object was partially in the posterior urethra and partially in the bladder.

The patient was immediately taken to the operating room where, under spinal anesthesia, an external urethrotomy was performed. A glass highball stirring rod, measuring 15 cm. in length and 6 mm. in width, was removed from the posterior urethra and bladder. There were no fragments. A No. 24 French sound was passed through the penile urethra with no evidence of obstruction. A No. 18 Bardex soft rubber catheter was anchored into the bladder through the penis and the wound closed subcutaneously with 00 chromic catgut and the skin with silk. The urine was slightly blood-tinged.

The patient was placed on sulfathiazole postoperatively for 5 days. The catheter became dislodged during the night of the fourth day and was not replaced. The skin sutures were removed on the eighth postoperative day, and the patient was discharged on the fourteenth postoperative day. He returned 2 weeks later for urethral dilatation. His stream was normal and the perineum well healed.

SUMMARY

The case of a 35-year-old male is reported, who, during a drinking bout, acquired a highball glass stirring rod within his posterior urethra. The foreign body was removed through an external urethrotomy and the perineal wound was healed in 4 days. It is interesting that the rod, 15 cm. in length, had been manipulated around the bend of the posterior urethra and partially into the bladder and was still in one piece.

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DIAGNOSIS OF LATE SYPHILIS

Seronegativity in patients treated late has no bearing on the prognosis and certainly cannot be accepted as sole evidence of cure. Asymptomatic neurosyphilis, the uniform precursor of the dread late neurosyphilitic manifestations, can be detected *only* by spinal fluid examination.—SCHAMBERG, L. I.: Prognosis of syphilis; a critical review of clinical, autopsy, and life insurance studies. Am. J. Syph., Gonor. & Ven. Dis. 29: 529–550, September 1945.

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ELECTROCARDIOGRAPHIC CHANGES IN CARBON TETRACHLORIDE POISONING

REPORT OF A CASE

HORACE B. CONAWAY
Commander (MC) U.S.N.R.
and
FREDERICK HOVEN
Pharmacist's Mate, second class, U.S.N.R.

A case of accidental poisoning caused by the ingestion of carbon tetrachloride was seen in a patient admitted to a U. S. Naval base hospital in North Africa, where serial electrocardiograms were taken. In this type of poisoning, damage to the liver, kidneys, adrenal glands, lungs, and brain is usually stressed, so it was thought the acute degenerative myocardial changes evidenced by the electrocardiograms in this case would be of interest.

Case report.—A 30-year-old Merchant Marine cook aboard a Liberty ship was admitted to this hospital complaining of epigastric burning, gnawing and crampy abdominal pain, flatulence, nausea, vomiting, diarrhea, dimness of vision, and frontal headache. These symptoms had become increasingly more severe during the preceding 36 hours, following the ingestion of several mouthfuls of fire extinguisher liquid (carbon tetrachloride). He had been drinking heavily during the preceding 24 hours.

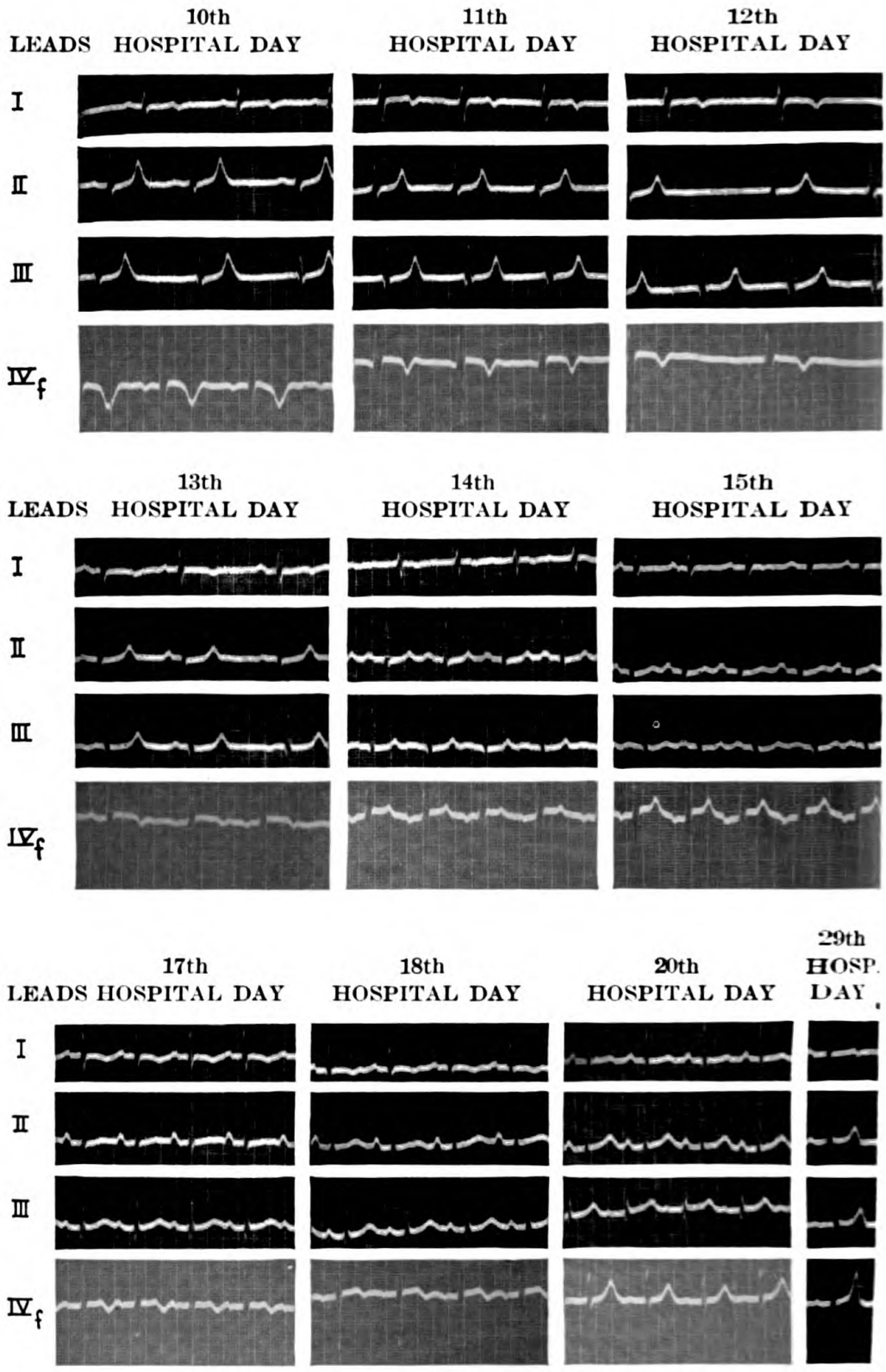
On admission he appeared apprehensive, nervous, and was suffering from acute upper abdominal pain and vomiting, which persisted throughout most of his illness. A distinct odor of carbon tetrachloride could be noticed on his breath. He did not appear acutely ill; the temperature was 100° F., pulse rate 106 beats per minute, regular, of good volume, and the respirations were normal. On the fourth hospital day he developed jaundice, an enlarged and tender liver, which eventually extended 4 fingerbreadths below the costal margin, a blood pressure of 150/100, and he began to show moderate, generalized anasarca.

Urinalysis showed from 100 to 200 milligrams of albumin, with two to four red blood cells per high-power field, and a few coarsely granular casts. The blood showed an icterus index of 30 milligrams per 100 cubic centimeters, the leukocyte count was 13,650, with a normal differential, and the blood nonprotein nitrogen was 200 milligrams per 100 cubic centimeters.

During this time the patient was treated with intravenous injections of dextrose and with symptomatic therapy. On the ninth hospital day he developed signs of circulatory and respiratory collapse, with marked cyanosis, rapid, irregular pulse, dyspnea, and pulmonary edema. At this time he became semistuporous, confused, and showed marked asthenia, hemoptysis and epistaxis. He was placed in an oxygen tent and given repeated doses of nikethamide and one dose of morphine, with good response.

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Cardiographic tracings were started the following day. His condition remained essentially unchanged during the next several days, during which time oxygen was continued, as were fluids and intravenous dextrose. On the fif-

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teenth hospital day the temperature was 101° F., the pulse rate 98 beats per minute, and respirations were 32 per minute, with chest signs suggestive of broncho-pneumonia. The leukocyte count was 16,600, with 4 percent band forms, 91 percent segmented cells, 4 percent lymphocytes and 1 percent eosinophils. The hemoglobin concentration was 71 percent; the erythrocytes numbered 3,930,000 per cu. mm. of blood. Penicillin therapy was instituted, 300,000 units being administered during a 3-day period, and two transfusions of 250 cc. of whole blood were given on successive days.

By the twentieth hospital day the patient was much improved and had a normal temperature and pulse rate. Laboratory findings were within normal limits. Three days later the liver edge was found to be only 2 fingerbreadths below the costal margin, with complete disappearance of the anasarca following a spontaneous diuresis. Convalescence was uneventful, and the patient was evacuated.

COMMENT

It is evident that the heart muscle suffers severe, acute degenerative changes in carbon tetrachloride poisoning, as indicated by the electrocardiographic findings in this case. The rapidly reversible changes in the serial tracings can well be attributed to cloudy swelling, fatty degeneration, or petechial hemorrhagic phenomena.

Serial electrocardiograms showed marked changes from day to day. Sinus bradycardia was followed by auriculoventricular nodal rhythm, auricular fibrillation, sinus arrhythmia, and normal sinus rhythm. A transient right axis deviation was present in two tracings. The P waves showed notching, broadening, and directional changes. The QRS complexes varied in amplitude and showed some splintering in later records (lead IV). T waves varied in voltage, direction and form, especially in leads I and IV, and $S–T_4$ showed some elevation, which returned to normal. The P–R interval remained at the upper limits of normal, later increasing to 0.24 second with subsequent return to normal.

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INTESTINAL OBSTRUCTION: FLAT ABDOMINAL FILMS

In cases of intestinal obstruction a Miller-Abbott tube or a Levin tube will frequently stop vomiting, giving a false impression of improvement, say Chicago's N. S. Zeitlin and M. S. Mazel. They depend considerably on the x-ray films for determining the cause of a distended abdomen. The frequency of vomiting and the rectal passage of small stools, they contend, are important but not conclusive. Flat films of the abdomen in acute cases will frequently reveal the correct diagnosis.—ZEITLIN, N. S., and MAZEL, M. S.: Intestinal obstruction; further experiences in use of flat abdominal films. Radiology. 45: 267–277, September 1945.

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MEDICAL AND SURGICAL DEVICES

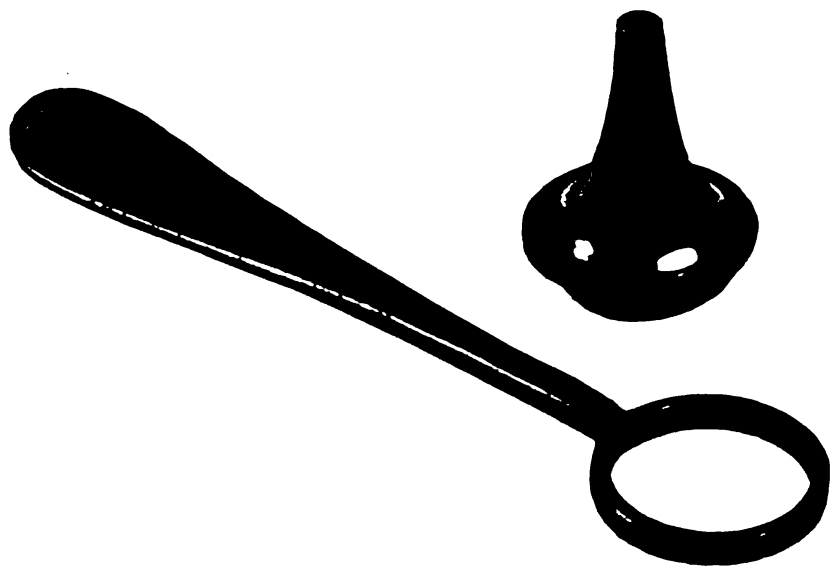
HANDLE FOR AURAL SPECULUM

ALBERT HAROLD WILLIAMS
Senior Assistant Surgeon (R) U.S.P.H.S.

When the need arose for approximately 600 ears to be examined daily at a Separation Center, a practical method of conducting otoscopy was sought, with a view toward convenience, minimal loss of time, and conservation of energy.

A circular metal ring was constructed to accommodate the medium-sized bakelite type of ear speculum which is supplied with the standard U. S. N. diagnostic set. The fit is a tight one, which, nevertheless, can be easily disassembled. To the outer circumference of the ring was fused a handle such as pictured in the accompanying illustrations. A light-weight metal with a moderately high degree of malleability is preferred. This handle extended 5 inches from the ring. The entire device was sprayed with black lacquer or had black enamel paint baked upon it to prevent distracting reflections of light rays. A very serviceable handle was obtained from surveyed spoons.

Two such instruments were used by the examiner, one reposing in

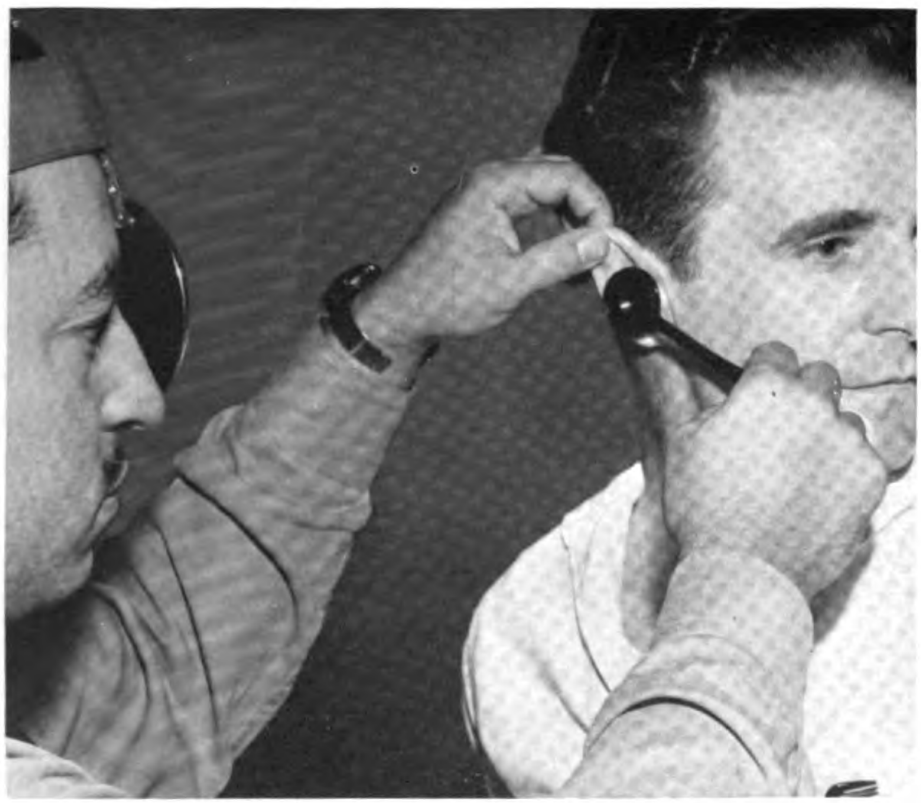


1. Instrument disassembled.

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2. Instrument ready for use.



3. Instrument in use.

a sterilizing solution while the other was actually being employed. A shallow basin not over 4 inches in depth and filled with antiseptic solution to its two-thirds level is recommended.[1] The standard Naval

[1] A solution of two parts of 70-percent alcohol with one part of acetone has the advantage of acting as a combination antiseptic and ceruminal solvent.

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issue cup, drinking, without handle, borrowed from the crew's mess, has been found well suited for this purpose. The assistant, who is also a recorder of the physical findings, removes the device from the solution, carefully wipes the outside of the speculum with a dry towel and places the instrument upon the table. The residual thin film of alcohol, acetone, and water is soon volatilized from the inside of the speculum.

1. This light-weight device is less fatiguing than is an electric otoscope with its heavy battery case, especially when used for a large number of examinations.

2. The speculum need not be removed for repeated cleaning and sterilizing as in the case of an electric otoscope.

3. The speculum is never handled with the fingers, thus obviating the not infrequent occurrence of fumbling with a smooth cone, which is often wet and slippery.

4. By means of this handle, the direction of the speculum may be guided with a well controlled amount of pressure and torsion necessary to straighten the serpentine shaped cartilaginous portion of the external auditory canal. This, of course, is aided by the application of posterosuperior traction of the pinna exerted by the thumb and forefinger of the examiner's other hand.

5. The use of the handle permits an unobstructed path of light from its source behind and beside the examinee to the head mirror worn by the examiner.

6. Use of a speculum with reflected illumination furnishes a view of the entire external auditory canal and the drum, without the exaggeration produced by the magnifying lens of an electric otoscope.

7. Need for replaceable batteries and special light bulbs is eliminated.

VITAMIN C IN ALLERGY

Vitamin C plays a valuable role in the treatment of nasal allergy, but is useful fundamentally in large doses ranging a minimum of 250 mg. daily with an optimum dosage of 750 mg. daily. Vitamin C is useful in allergy either by oral therapy or by injection. The results of the administration of vitamin C are in general advantageous to allergic patients with or without desensitization. In some cases vitamin C therapy alone proved superior to pollen desensitization in previous years. Allergic disturbances are related to nutritional deficiencies, primarily that of ascorbic acid.—RUSKIN, S. L.: High dosage vitamin C in allergy. Am. J. Digest. Dis. 12: 281–313, September 1945.

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MODIFICATION OF THE ZIMMER CLAMP FOR CRANIAL SKELETAL TRACTION

JONATHAN M. WILLIAMS
Lieutenant Commander (MC) U.S.N.R.

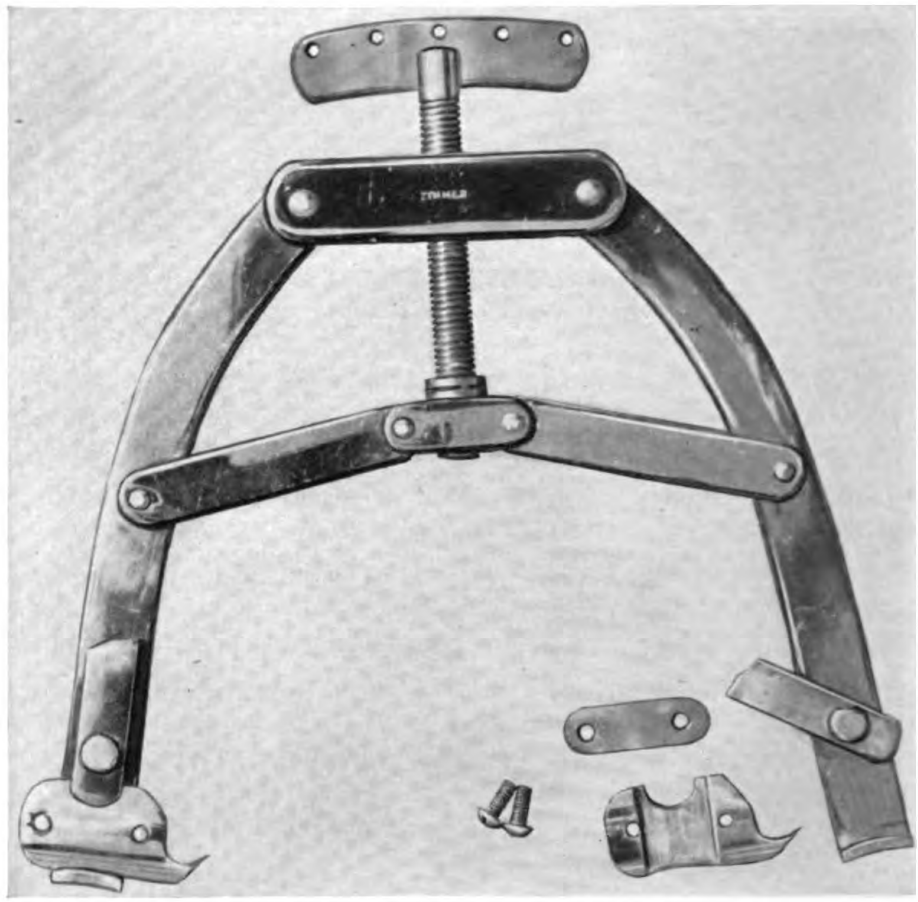
Recently it became necessary in the treatment of a fracture dislocation of the cervical region to apply skeletal traction via the skull. The facilities at hand were meager and did not include either Crutchfield tongs or other instrument which might have been suitable as a substitute.

Attention was finally focused on the large size Zimmer clamp, such as is used for skeletal traction with Kirschner wires. However the Kirschner wires, such as this instrument was built to accommodate, were too supple to permit an intended 25-pound traction, and such is

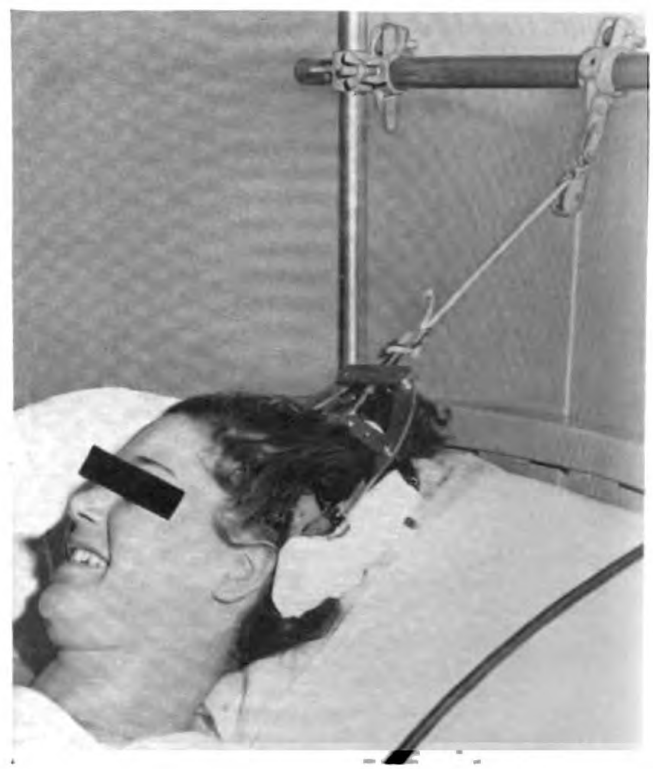


1. Reverse of clamp.

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2. Disassembled clamp.



3. Clamp in use.

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the clasping action of the clamp that a Steinmann pin, more desirable because of greater rigidity, could not be held securely.

However it was noted that the pivotal point of the fixing member intended to hold the Kirschner wire was eccentrically placed. This made it possible to rotate the fixing bar 180 degrees and thus have a gap of approximately 1.5 cm. between the bar and the lip at the distal limb of the clamp. This suggested the possibility that a suitably shaped metal bar could be forged and inserted firmly in this gap and used for the sharp member which pierces the skull and affords the necessary skeletal fixation.

As a temporary expedient, a chief machinist's mate cut from stainless steel two serviceable "hooks" or "points" which snugly fitted into the above-mentioned gap. This makeshift piece of apparatus was in use for a number of days. Later refinements consisted in increasing the angle, shortening the length of the penetrating portion of the point, and devising a more secure fixation of the point on the Zimmer clamp.

By shortening the length of the point there was less likelihood of penetrating too deeply, and by increasing the angle of the engaging tip, this tended to "set itself" into the bone.




HYPERINSULINISM AS A FACTOR IN PEPTIC ULCER

Peptic ulcer is found only rarely in diabetics and this suggests some difference in constitution, since both are constitutional diseases. Hyperinsulinism can produce the symptoms of peptic ulcer, and the chronic hypoglycemia often induces hyperperistalsis and spasm which might lead to ulcer. The assumption that all cases of peptic ulcer have hyperinsulinism furnishes a ready explanation for the diabetic's comparative freedom from the other disease.

Experiments showed that peptic ulcer patients actually have hyperinsulinism. The fact that patients with the clinical diagnosis of peptic ulcer, but without x-ray confirmation of that diagnosis, have the same type of glucose tolerance curves as those in whom the confirmation was present leads to the possibility that the hyperinsulinism, or at least the chronic hypoglycemia, might have some etiologic relation to ulcer. The role of caffeine in producing hyperinsulinism suggests that we re-evaluate the assumed harmlessness of that alkaloid.—ABRAHAMSON, E. M.: Hyperinsulinism as a factor in peptic ulcer. Am. J. Digest. Dis. 12: 379–382, November 1945.

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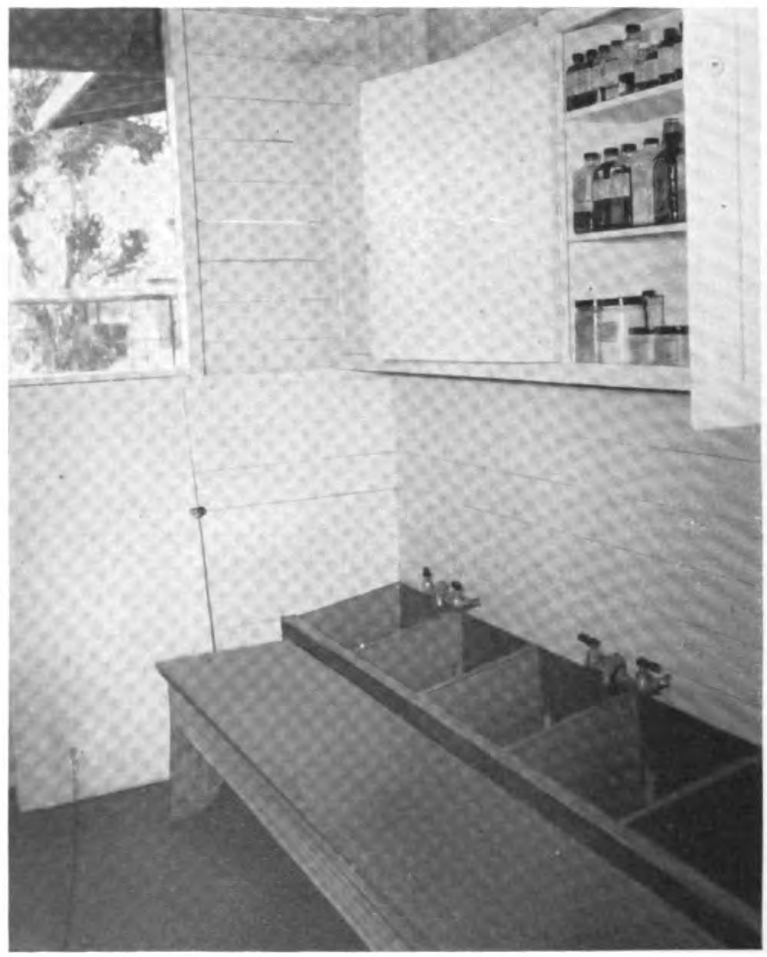
STREAMLINED FOOT BATHS

EDWARD F. ADDENBROOKE
Commander (MC) U.S.N.R.

As a rule the administration of foot baths is an untidy affair. Buckets, pans, and basins are strewn about, and damp floors are stained by silver nitrate, potassium permanganate, or iodine.

The accompanying illustration shows a foot-bath device constructed of galvanized iron by the 46th Naval Construction Battalion.

Each compartment was 2½ inches lower in front than in the back, measuring 9 inches in height in front and 11½ inches at the back. The sides of each compartment measured 18 by 15 inches. There were six such compartments, making an over-all length of 83 inches.



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Three sets of faucets with swinging arms were so placed that each set served two compartments.

The inner surfaces of the compartments were painted with aluminum paint. They were scrubbed clean each night and disinfected. About every 10 days the paint was scraped down and the compartments repainted.

Five of the compartments were used for foot baths, the sixth being kept for sitz baths. A 3-gallon mark was placed about one-half way up the wall of each compartment. With this known amount of water in the compartment, addition of a measured amount of concentrated stock solution gave the desired dilution for the bath. These solutions were kept in a shelf cabinet above the tubs.

When the patient has finished his soak he reverses his position; the feet are placed on a footrest, dried, and further treatment or dressings applied if indicated.

With the device and method described, a hospital corpsman or nurse can easily and neatly treat 12 patients per hour, and with no scattering about of basins, or spilling and staining by medicaments.

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TRANSMISSIBILITY OF LEUKEMIA

Attempts were made to transmit leukemia from man to man. Material used consisted of blood and lymph nodular and splenic emulsions of chronic myeloid, lymphatic, and acute leukemias. Attempts were made with whole blood to cross-transmit chronic myeloid leukemia to patients with chronic lymphatic leukemia and vice versa. All transmission attempts from man to man and cross-transmissions between patients with leukemia failed with a period of observation of two years.—THIERSCH, J. B.: Attempted transmission of human leukemia in man. J. Lab. & Clin. Med. **30**: 866–874, October 1945.

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CURABILITY OF MADURA FOOT

The statements of Strong and Manson-Bahr in the latest editions of their textbooks of tropical diseases, namely that the only effective treatment of Madura foot is amputation, apparently no longer hold true. Probably the fungistatic action of the sulfonamides is a sufficient support to aid nature in her attempt to cure this infection. This is analogous to the results of the well known bacteriostatic action of these drugs.—PETERS, J. T.: Clinical cure of Madura foot. Am. J. Trop. Med. **25**: 363–365, July 1945.

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BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.
(For review)

DISEASES OF THE BREAST, Diagnosis, Pathology, Treatment, by *Charles F. Geschickter, M. A., M. D., Lieut. Comdr. Medical Corps, U. S. N. R.; Director of The Francis P. Garvan Cancer Research Laboratory; Pathologist, St. Agnes Hospital, Baltimore.* With a Special Section on Treatment, in Collaboration with *Murray M. Copeland, A. B., M. D., F. A. C. S., Instructor in Surgery, Johns Hopkins Medical School; Visiting Surgeon and Assistant Oncologist, University Hospital, University of Maryland Medical School; Visiting Oncologist, Baltimore City Hospitals.* 826 pages; 593 illustrations. 2d edition. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1945. Price $12.

This second edition closely parallels the first, but, as the author states in the preface, the orientations to the seven major divisions of the book have been enlarged and rewritten, the chapter entitled "Mammary Cancer" has been enlarged and the chapter on the "Mechanism of Tumor Formation" has been rewritten.

The scope of the text is most comprehensive and the arrangement orderly. It is divided into seven parts. Each part is preceded by a preface or orientation, which forecasts in condensed form the subject matter later described in detail.

Part One deals with mammary development and includes comparative anatomy and embryonic development of the human breast; physiologic changes in the breast, both normal and pathologic; and discussion of approved methods of examination and diagnosis. Part Two considers both normal and abnormal changes in the breast due to pregnancy and lactation. Part Three deals with chronic cystic mastitis. Under this caption are grouped mastodynia, so-called adinosis or Schimmelbusch's disease, and cystic disease (both solitary cysts and multiple cysts). Chapter Eleven of this section considers in great detail the endocrine aspects of chronic cystic mastitis. Part Four tabulates and describes benign mammary tumors. Part Five is de-

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voted to malignant mammary tumors, and as would be expected, the longest portion deals with malignant tumors of epithelial origin. Part Six is concerned with the treatment of mammary lesions, and includes consideration of simple and radical surgical methods and technic, chemo- and endocrine therapy and irradiation. For cancers confined to the breast, radical mastectomy only is considered the proper treatment. However, in those cases with axillary metastases, post-operative irradiation by modern technic increased the five-year survivals of the author's series from 25 to 30 percent. Preoperative irradiation does not add to the percentage of cures and is an inadvisable procedure. Part Seven details the experimental production of benign and malignant mammary tumors.

In describing mammary tumors, the author follows a more or less individual classification as formerly adopted by Bloodgood. Contrary to accepted terminology, the word cancer is used as synonymous with carcinoma. Some of the graphic charts given are quite complex and rather than simplify the text, tend to confuse the rapid reader. There is often much overlapping and repetition and there is one theme which runs throughout the book. Its repetition impresses the reader with the tremendous amount of valuable experimental work done by the author and his coworkers in the field of estrogenic and luteal hormones as causative factors in the production of mammary dysplasia and this paves the way for the theoretic discussion of the mechanism of tumor formation.

Schimmelbusch's disease, or so-called adenosis, is regarded as a more advanced stage of mastodynia and develops as the result of stimulation by excess of estrogenic substances in a breast lacking in lobule formation. Multiple cystic mastitis represents an advanced condition of adenosis, but is more likely to develop in a breast in which lobule formation is more nearly normal and when estrogen stimulation has been withdrawn. Experimental data is presented to show the dependence of lobule formation on luteal hormones and lutein-like substances, especially testosterone. Schimmelbusch's disease and chronic cystic mastitis are not considered possible precancerous lesions, but as dysplasias caused by imbalance of estrogenic and luteal hormones. However if this imbalance is persistent and of marked degree in favor of estrogen, malignant change may result.

The chapter on the Mechanism of Tumor Formation departs somewhat from the truly scientific and invades the field of philosophy. The reader should consider it in this light. Editing has been carefully done. The only typographic error noted occurs on page 642. The word "radical" appearing here was evidently intended to be "radial." The references appended to the end of each chapter are exhaustive. The value of the text is enhanced by many well chosen

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illustrative photographs and photomicrographs and by several unusual pen and ink drawings depicting the characteristics on palpation of the various mammary tumefactions. The complexities of endocrine physiology are complicated by confusing names given to the various natural hormones and their many synthetic cousins. But parenthetic definitions are given in the body of the text so that a neophyte may attempt to understand. Yet the discussion retains its postgraduate level of interest for the close student of endocrinology.

CLINICAL PARASITOLOGY, by *Charles Franklin Craig, M. D., M. A. (Hon.), F. A. C. S., F. A. C. P., Colonel, United States Army (Retired), D. S. M.; formerly Director, Army Medical School, and Assistant Commandant, Army Medical Center, Washington, D. C.; Emeritus Professor of Tropical Medicine in the Tulane University of Louisiana, New Orleans, La.; and Ernest Carroll Faust, M. A., Ph. D., Professor of Parasitology in the Department of Tropical Medicine, Tulane University of Louisiana, New Orleans, La.; Consultant to the Secretary of War, Army Epidemiologic Board on Epidemic and Tropical Diseases.* 4th edition, thoroughly revised. 871 pages; illustrated with 305 engravings and 4 colored plates. Lea & Febiger, Philadelphia, Pa., publishers, 1945. Price $10.

Since only two years have elapsed since the previous edition of this book, the present fourth edition may be critically analyzed for changes important enough to justify a "thoroughly revised" publication at this time. Evidence of expansion is reflected in the increase in size from 767 to 871 pages. Part of this increase is found in the introductory material which has been changed from a single chapter to six, covering the same material in more detail; some new material has been added, especially in regard to the distribution of human diseases and climate. Most of the increase is found in the section on Arthropods and Human Diseases. The recent, and sometimes bitter, experience of the Armed Forces is reflected in this recognition of the increasing importance of medical entomology.

The changes throughout the text primarily involve the incorporation of data that has accumulated or has been published during the past two or three years. The addition of a paragraph on Pathogenicity for each parasite does not appear to add as much as is inferred from the reference in the Preface. Some of the text has been rewritten in part without major alteration of the content. The increased emphasis on diseases caused by bacteria and viruses and transmitted by arthropods is surprising in a book on parasitology. The authors justify these details on the basis of more closely associating these infections with their vectors; by so doing they have left the field of parasitology and entered that of tropical medicine.

The bibliography is extensive and includes 14 textbooks or manuals published or revised in 1943 to 1945 and not included in the former editions. Of nearly twelve hundred other references, more than two

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hundred were not previously listed; some of those cited are dated prior to 1940 to cover new material on arthropods and diseases referred to above. There is a minimum of new material on laboratory technics. DDT and the repellents are briefly mentioned in the discussion on control of certain insects. The newer drugs used in the treatment of leishmaniasis are included.

The section on malaria, our most important parasitic disease, is disappointing in part. The four color plates are no better than they were in the previous edition, much poorer than can be found in other publications. The recommended therapy is that abandoned by the Navy over two years ago; specifically exception may be taken to the statements that quinine continued sufficiently long will cure malaria and that every malaria case should have a course of plasmochin; the recommended dosage of atabrine is unchanged from that of prewar days.

The present edition might well replace older copies, but most of those having a third edition will find it adequate.

THE CARE OF THE NEUROSURGICAL PATIENT, by *Ernest Sachs, A. B., M. D.* 268 pages, 177 illustrations. The C. V. Mosby Co., St. Louis, Mo., publishers, 1945. Price $6.

The author, one of the neurosurgical pioneers in this country, has drawn on his long experience to present his views on the management of the neurosurgical patient. The text is profusely illustrated and divided into sections on preoperative examination and care, the operating room, anesthesia, a general discussion of neurosurgical methods, surgical technic, and postoperative care. In the final chapter the author presents a brief review of the development of neurosurgery as a specialty, and philosophizes on the question of operating on desperate cases and the future of neurosurgery.

Despite the brevity of the text, a considerable amount of valuable information is encompassed. Particularly interesting and unique features are the detailed descriptions of such items as surgical instruments, dressing carts, and other operating room equipment. These bits of essential information are generally omitted in neurosurgical writings.

Interns and residents, particularly those charged with the responsibility of a neurosurgical service, will find the volume a handy guide in the care of their patients. Dr. Sachs not only describes important points on technic but gives the reasons why these points are essential.

Neurosurgeons will likewise find valuable suggestions in the section on operative technic. However, a number of them are likely to disagree with some of Dr. Sachs's statements concerning anesthesia, the surgical treatment of focal epilepsy, repair of spina bifida with meningocele or myelomeningocele and cranioplasty. Curiously enough,

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surgery of the sympathetic nervous system is deleted from the text although the studies of Peet, Adson, and Smithwick in the surgical treatment of hypertension are mentioned in the final chapter. This omission is perhaps justifiable since these procedures are frequently performed by general surgeons.

Two additional shortcomings of debatable importance are noted. Classic contributions are at times omitted in establishing the historic background for the various operative procedures. Secondly, information on the recent developments in traumatic neurosurgery is deficient. However the author is perhaps justified in not sanctioning the newer methods until they have withstood the test of time.

GOVERNMENT IN PUBLIC HEALTH, by *Harry S. Mustard, B. S., M. D., LL. C., DeLamar Professor of Public Health Practice, and Director, School of Public Health, Faculty of Medicine, Columbia University.* 219 pages. The Commonwealth Fund, New York, N. Y., publishers, 1945. Price $1.50.

In 1942, a "Committee on Medicine and the Changing Order" was established by the Council of the New York Academy of Medicine in order to delve into problems that were facing "medicine of the future." Dr. Mustard was chosen to write a monograph, to help evaluate the future needs of public health medicine. This was to be a sociologic and historic treatise rather than a technical one.

Dr. Mustard has done a fine job in writing this monograph of 219 pages. He has written a scholarly, critical and historic evaluation of public health practice in this country dating back to prerevolutionary war days. He has indicated the numerous ramifications and cross currents of local, state, and Federal influences in public health. He has shown the why and how of Federal "grants-in-aid" in elevating public health practices in this country where it was most needed and is still needed. He shows historically how "compulsory health insurance" was established in 1798 for "sick and disabled seamen," and that therefore compulsory health insurance is far from a new idea.

One can readily trace in the text the undulating cycles of progress toward a better public health practice and service for the citizens of the United States and how there have always been the inevitable controversies among the local, state, and Federal health authorities, and politicians.

Dr. Mustard makes strong point of the need of a good basic local health program before additional Federal monies are injected to aid in the expansion and engaging of novel health activities. One is impressed with the fact that a better public health practice is now in effect as compared with even recent decades. However continuous effort and good adult and public education are essential to produce a progressively adequate public health program.

Those who are interested in any phase of public health, be they

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administrators, legislators, physicians, or those contemplating organized health practices, should find their time well compensated with reading this small volume.

THE HISTORY OF SURGICAL ANESTHESIA, by *Thomas E. Keys*, with an Introductory Essay by *Chauncey D. Leake* and a concluding chapter, The Future of Anaesthesia, by *Noel A. Gillespie*. 191 pages; illustrated. Schuman's, New York, N. Y., publishers, 1945. Price $6.

Major Thomas E. Keys has given us a history of anesthesia from the beginning, wherein the Lord is given credit for being the first anesthetist. He has given ample credit to the scientists producing or describing the various anesthetic agents that have been or are in present use. He has not adequately described the debt that modern surgery owes to the development of good anesthesia. Without such development, surgical procedures as performed today would be impossible.

Practically every physician has in his library several books on the history of medicine. Modern anesthesia has been developed more by the physicians of this nation than those of all other countries combined. There should be no more fascinating historic subject for the physicians of this country; it was in these United States that the first surgical procedure was performed under ether anesthesia. Who administered the first ether anesthetic is still a sectional controversy. Major Keys does not enter into this argument, but allows facts to speak for themselves.

Illustrations of original anesthetic apparatus and procedures are excellent. In one of the addenda, *Selected References Arranged by Subject*, a comprehensive bibliography is presented.

In the concluding chapter, *The Future of Anesthesia*, Dr. Noel A. Gillespie brings to our attention the tremendous need for professional anesthetists; he also stresses how inadequately the subject is taught in most of our medical schools.

This is a book every physician could profitably read, and as a reference book it is valuable to the anesthesiologist.

DR. W. C. RÖNTGEN, by *Otto Glasser, Cleveland Clinic Foundation*. Charles C Thomas, Springfield, Ill., publishers, 1945. Price, $4.50.

Late on Friday afternoon, 8 November 1895, Wilhelm Conrad Röntgen was experimenting to see whether rays from a Crookes tube would be apparent, even if the tube was covered with a cardboard jacket. Darkening the room, no light was seen. Suddenly he saw a weak light shimmering from a spot nearby, where he knew a small bench was located. He again passed a series of discharges through the tube and again the same fluorescence appeared. Highly excited, he lit a match and discovered that the source of the mysterious light was a little barium platinocyanide screen lying on the bench.

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During the next days he continued secretly and feverishly his research, found that the rays reached the screen through various materials, and that these materials put shadows on the screen. "To test further the ability of lead to stop the rays, he selected a small lead piece, and in bringing it into position observed to his amazement not only that the round dark shadow of the the disk appeared on the screen, but that he suddenly could distinguish the outline of his thumb and finger, within which appeared darker shadows—the bones of his hand."

On 28 December he published "On a New Kind of Rays, a Preliminary Communication," and on 1 January 1896 he mailed reprints of this to physicist colleagues in Germany, France, and England.

By 5 January the news was in the public press; on 6 January it was cabled over the world. On 13 January, on command, he demonstrated before Kaiser Wilhelm II in Berlin and was decorated with the Prussian Order of the Crown.

On 3 March he received the honorary degree of Doctor of Medicine from the University of Würzburg. On 16 April he was made honorary citizen of the town of Lennep, his birthplace. Four days later the Royal Order of the Bavarian Crown was bestowed.

And so on through succeeding months, showers of medals, honorary memberships, and prizes were accepted or declined and in 1901 (the first year of Nobel awards) he received in Stockholm the Nobel prize in physics.

This achievement and these sudden honors, however, were those earned by a full man. Fifty years of age, he had over a hard road attained eminence and recognition in physics. Chance had some part, but he was prepared to accept the challenge of the phenomenon and to trace the cause and effect.

He presented the results of his investigations in three papers, the second appearing in March 1895, the third a year later. These are models of brevity and simplicity. "As in Luther's theses there is never 'a word too little and never a word too much'."

This little volume makes dramatic reading, from his birth 100 years ago to his death after Germany's debacle, his last years in the depressing times of national financial chaos.

Honors never came more deservedly or quickly, and the world's respect stayed with him through the 28 years to his death.

FRACTURES OF THE JAWS, by *Robert H. Ivy, M. D., D. D. S., F. A. C. S., Professor of Plastic Surgery, School of Medicine and Graduate School of Medicine and of Clinical Maxillo-facial Surgery, School of Dentistry, University of Pennsylvania; Chief of Plastic Surgery, Graduate Hospital; Consultant in Plastic Surgery, Children's Hospital, Philadelphia; Plastic Surgeon to the Presbyterian Hospital; Colonel, Medical Officers Reserve Corps, U. S. Army; and Lawrence Curtis, A. B., M. D., D. D. S., F. A. C. S., Associate Professor of Plastic Surgery.*

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Graduate School of Medicine; Assistant Professor of Maxillo-facial Surgery, School of Dentistry, University of Pennsylvania; Chief of Oral and Plastic Surgery. 3d edition, thoroughly revised. 174 pages; illustrated with 199 engravings. Lea & Febiger, Philadelphia, Pa., publishers. Price, $4.50.

In the third edition of this popular work the authors describe several methods of treatment of mandibular and maxillary fractures, which methods were not included in earlier editions.

The text advocates methods which may be employed by the surgeon, oral surgical specialist, or the dental practitioner immediately without the necessity of delay in reduction and fixation which at times have been occasioned by waiting technical dental laboratory procedure.

The first chapter is limited to a review of anatomic consideration in fractures of the jaws. Subsequent chapters consider these fractures particularly as to the area in which they occur and outline procedures to be followed in treating them.

The chapter on "Roentgenographic Technic" by LeRoy M. Ennis, and that on "Dietary Management of Fractures of the Jaws" by Clyde W. Scogin, which are included as a part of the text, are a particularly valuable addition to the volume. These subjects are of paramount importance in treating fractures of the jaws, and in the past have frequently received less consideration than they merited.

The book is considered to be an excellent and concise compendium of procedure relative to the treatment of fractures of the jaws. It will make a wide appeal to both physicians and dentists who are interested in this field of professional activity.

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MANAGEMENT OF CHEST WOUNDS

Very few casualties with wounds of the chest who survive to be evacuated from the battlefield should die if properly equipped trained surgeons are available for their care. Anesthetists well trained in endotracheal anesthesia for thoracic surgery are essential to the proper care of war wounds of the chest. Endotracheal oxygen ether, administered through a closed apparatus capable of positive pressure is the preferred anesthesia in all perforating and penetrating wounds of the chest. Proper occlusion of open chest wounds with gauze and adhesive strapping is the preferred management until the patient is in a hospital equipped and staffed to do intrathoracic surgery.

Early and repeated aspiration of hemothoraces, without air replacement, is essential to the proper management of chest wounds. Hemorrhage has not recurred because of this practice. Early aspiration of large pneumothoraces and continuous aspiration by catheter water-seal drainage of pressure pneumonothoraces must be accomplished to secure a high survival rate in such conditions. Intercostal nerve block to relieve pain, promote deeper breathing and to facilitate expulsion by cough of blood and mucus in the tracheobronchial tree, is an important adjunct to therapy. Tracheal catheter suction has an important place in the pre- and postoperative management of chest wounds.

Bronchoscopic aspiration of blood and mucus from the trachea, main stem bronchi and lobar bronchi is a good practice at the termination of every operation upon a patient with a chest wound. It may be indicated in the preoperative, operative, and postoperative periods when less radical measures fail to clear the tracheobronchial tree. Replacement therapy is most important in chest wounds. Whole blood is the preferred fluid. Autotransfusion of pleural blood should be used whenever practicable. Care must be exercised to give the blood slowly after the systolic blood pressure has reached 80 mm. Hg. and to give no more blood than is necessary to attain adequate resuscitation. Most wounds of the chest need only debridement of the chest wall, preceded and followed by proper chest management, replacement therapy, and oxygen therapy.

Evacuation from the pleura of blood, air, and all foreign bodies, and irrigation of the pleura with physiologic salt solution is desirable in the surgery of perforating and penetrating wounds of the chest. Complete expansion of the lung by inflating it out to the chest wall and evacuation of all pleural fluid and air should be attained at the end of all operations in which the pleura is opened. Sulfonamide or penicillin therapy should be continued until the pleura is free of all air and fluid and until any lung consolidation has resolved.—SNYDER, H. E.: Management of intrathoracic and thoracoabdominal wounds in combat zone. Ann. Surg. 122: 333–357, September 1945.

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PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge

REPORT OF FOOD-BORNE STREPTOCOCCUS OUTBREAK

JOSEPH D. PURVIS, JR.
Lieutenant Commander (MC) U.S.N.R.
and
GEORGE C. MORRIS
Lieutenant H(S) U.S.N.R.

On 5 September 1945 an outbreak of acute upper respiratory infections occurred at a repair base on southern Okinawa. The outbreak was explosive in nature, 2 patients being admitted the first day, 3 the second, 69 the third, 45 the fourth, and 14 on the final and fifth day, a total of 133 men.

Clinical examination of the patients indicated that the causative organism was most likely a streptococcus (later proved by bacteriologic examination of throat cultures), and the explosiveness of the outbreak indicated that the organism probably had been disseminated by food or water.

The messhall had been serving "10 in 1" rations. Ice cream, made at the base, was being served about once a week. Milk for breakfast cereal was prepared by diluting equal parts of canned evaporated milk and water in a large container immediately before use. Chocolate milk had been served on one occasion. Milk for drinking was served daily at breakfast and was prepared from powdered milk mixed each evening and stored overnight in a reefer. The mixing of this milk was done by two men. On inspection it was found that one of these men had an infected cut on his right wrist. Unfortunately, at the time of the inspection, the evening of the third day, none of the milk mixture was available for culture.

The remainder of the galley and messhall inspection was noncontributory. Storage spaces were reasonably clean and operating at approved temperatures. Scullery technic was adequate. The water supply was adequate and was being treated and tested in a systematic and approved fashion.

Among the food handlers, in addition to the powdered milk mixer with the infected wound, the following potential sources of infection were found: Two men with bandaged recent cuts; one with a clean

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recent burn; one scullery worker with a nondraining digital abscess; two men with head colds; and one man with a sore throat.

The messhall had been serving approximately 2,800 men at morning and evening meals and about 3,200 men at noon. The additional 400 men were Seabees who were constructing the base. No cases occurred among this group of men.

The galley crew consisted of 128 men, of whom 74 were food handlers. Throat cultures were made on 71 of the 74 food handlers and also from the cut on the milk mixer's wrist. In addition scrapings from the throats of 21 representative patients were cultured. Nine of these were cases of scarlet fever; the other 12 were cases of tonsillitis and pharyngitis. All the patients had received between 7 and 10 gm. of sulfadiazine before the cultures were taken. The cultures were all streaked directly onto 5-percent human blood agar plates.

Typical Streptococcus pyogenes colonies were isolated from 8 of the 9 cultures taken from scarlet fever cases, from 8 of the 12 cases of tonsillitis and pharyngitis, and from 5 of the 71 food handlers. The throat culture of the powdered milk mixer was one of these 5 positive cultures. In addition a heavy growth of Streptococcus pyogenes was obtained from the culture made of the material from his infected cut. This was an interesting finding in view of the frequency with which the same strain of streptococcus has been isolated from the throat as well as the infected wound in cases of so-called "wound scarlet."

Specimen cultures from 17 positive plates were sent to the laboratory for grouping and typing. One of these cultures was broken in transit and one was found to be heavily contaminated. The remaining 15 cultures were tested by the Lancefield precipitin reaction and found to be growing Streptococcus pyogenes, group A, which gave positive reactions to both type 8 and type 34 sera. They were tentatively classified as type 8–34 although the possibility was recognized that they may have been a new type.

The epidemiologic evidence pointed directly to the powdered milk mixer as having been the source of the causative organism, and the powdered milk mixture as the means of transmission to the other men. It was impossible to prove whether the contamination occurred from this man's throat or wrist, although the latter seemed the more logical in view of the ease with which contamination could have occurred during the procedure of handling and mixing the powdered milk. Contamination by sneezing or coughing obviously could easily have occurred.

Appropriate recommendations were made to ensure good galley and messhall technics. Daily inspections of all food handlers for further evidence of respiratory or digital infections were advised. The serving of all milk and creamed foods was temporarily suspended. Cereal and coffee cream was served only in individual cans of undiluted evapo-

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rated milk. The base was temporarily isolated to prevent any possible spread to neighboring camps.

The medical officer at the base instituted throughout the camp a prophylactic sulfadiazine regimen, using a 1-gm. daily dose. This was suspended after 10 days. One mild case of dermatitis of a pruritic exfoliative type and several cases of urticaria occurred as adverse reactions, probably due to the sulfadiazine.

The outbreak subsided almost as rapidly as it started. It was felt that this was due chiefly to the nature of the outbreak and that probably the use of sulfadiazine as a prophylactic measure played at the most a minor role. Several of the patients were moderately ill on admission but responded well to chemotherapy. During the 3 weeks following the outbreak there was no indication of a persistence of the infection among the base personnel as evidenced by the dispensary and sick-call rates. No immediate complications were noted in any of the patients.

SUMMARY

1. An explosive outbreak of upper respiratory infections occurred at a 2,800-man base on southern Okinawa. In all 133 men were involved.

2. The causative organism was found to be Streptococcus pyogenes, group A, which reacted positively with both type 8 and type 34 sera. It was tentatively classified by Naval Medical Research Unit No. 2 as group A, type 8–34, although the possibility was recognized that it may have represented a new type.

3. The same organism was isolated from the throat and from an infected cut on the wrist of a man who regularly mixed powdered milk for drinking and for use on breakfast cereal.

4. Epidemiologic evidence seemed to indicate clearly that the organism was food-borne, that the powdered milk mixer was the source of the organism, and that the powdered milk mixture was the method of transmission. Whether the organism originated in this man's throat or in the infected cut on his wrist remains debatable.

5. The outbreak subsided as rapidly as it began.



INCIDENCE OF TRICHINOSIS

The mortality rate from clinical trichinosis in the United States is 5 to 6 percent. It has been said that "trichinosis is one of the major health problems in the United States" and that "the United States has the greatest problem of trichinosis of any country in the world." At the present time the public is not sufficiently protected against the dangers of this disease.—GOULD, S. E.: Trichinosis; major health problem in United States; what shall be done about it? Bull. New York Acad. Med. 21: 616–624, November 1945.

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SOYBEAN MILK-SUBSTITUTE

AS USED ON OKINAWA

MAYO L. EMORY
Surgeon U.S.P.H.S.

Following the recent campaign for Okinawa the nutrition of the native children presented a serious problem. Both malnutrition and undernutrition were universal and starvation was common. The nutrition of children under 6 years of age suffered the greatest. The caloric demand for children in this age group was naturally greater than in adults, as they required food, especially protein, for growth as well as for repair. The children under 6 years of age were not in an advantageous position to obtain food for themselves. This was especially true for children under 4 years of age who were unable to forage for themselves.

Breast-fed children suffered the most. The quality of mother's milk was not only poor due to the parent's inadequate nutrition, but the milk was scant for the same reason. The quality of milk further progressively deteriorated in those mothers who nursed children for long periods of time. Okinawan children are usually nursed through the second year.

Not only the kind but the quantity of food available for the natives was limited. There was an urgent need for a food that could be easily prepared and easily distributed, which did not require any special equipment or trained personnel, which could be concocted from existing supplies, and which was acceptable to native tastes. Soybean was one of the foods available. It was found that a substance closely resembling milk (table 1) was produced as an intermediate step in the preparation of a native soybean dish *tofu*.

On 18 July 1945 the formula was made up experimentally in a native kitchen and tried out in General Hospital G6–59 on the pediatric ward. The following day the formula was also used in the orphanage of 142 children of Dispensary G10–20. The food was readily accepted by the children. During the first 3 days of use some of the children passed large soft stools which were greenish in color. However the stool rapidly returned to normal without treatment and without stopping the use of the formula. One cupful, approximately 200 cc., was given each child before the noon meal. Those who wished more were given more. The children in the orphanage ranged from less than 1

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year to 12 years of age. Simultaneously with the soybean formula, an experiment with dehydrated egg powder was carried out. It was found the egg powder could be added easily to the soybean formula to make a more valuable food. On 29 July the experiments were concluded.

It was then proposed to other civilian areas under Military Government that a portion of their soybean ration be diverted for the manufacture of this soybean milk-substitute for the children in schools, orphanages, and medical installations. It was felt that by this means extra food for the children could be assured without increasing the over-all ration of the population. At the same time a request for all excess dehydrated egg powder on Okinawa was made of the military. On 19 August an allotment of 372 pounds of egg powder every 10 days was granted for this purpose.

A survey completed on 25 August showed that a number of civilian camps had adopted the formula and that 4,200 persons were receiving the food daily. It was being used in schools and orphanages and in hospitals for children and for debilitated patients. It was also supplied to some of the aged in the old persons' homes. Some of the native doctors had adopted the use of the food. There were plans for further expanding the program.

Due to the difficulties of supply following the typhoons, the plan was later curtailed. This was considered a temporary measure. After 1 September the author was no longer associated with the work.

The method of preparation was simple. No special Military Government equipment or personnel was required to make the soybean milk-substitute. Equipment required was a suitable native container for soaking the beans, two native grinding stones about 10 inches in diameter, cheesecloth bags for straining the preparation, and suitable containers for dispensing the milk (tin cans). Four natives (one cook and three helpers) could prepare enough milk-substitute to feed a thousand children. Established native kitchens made large quantities of the milk-substitute without interfering with their existing

TABLE 1.—*Food values*

Product	Solids (percent)	Fat (percent)	Protein (percent)	Carbohydrates (percent)	Minerals (percent)	Water (percent)	Cal. per 100 gm.
Cow's milk	12.9	3.9	3.2	4.9	0.8	87.1	67.5
Human milk *	12.0	4.0	1.5	7.0	.2	88.0	80.0
Tofu **	17.5	3.5	10.0	4.0	?	82.5	87.5
Bean residue	10.0	2.0	4.0	4.0	?	90.0	60.0
Dehydrated egg	95.0	41.8	48.9	1.2	3.1	5.0	576.6
Tofu and sugar	19.1	3.4	9.8	5.9	?	80.9	58.1
Egg and sugar	11.5	4.1	4.9	2.1	.3	88.5	64.9
Soybean, egg, and sugar	15.3	3.8	7.4	4.0	.2	84.7	66.5

* These values are for the milk of American women.
** These values are for the finished *tofu*. There is no essential difference in the *tofu* product and the soybean milk.

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duties. The addition of two or three assistants might be required where a thousand or more children were being fed.

A by-product of the soybean milk-substitute was the bean residue. It had a food value of 60 calories per 100 grams. It was eaten as a food, generally in soups, by both adults and children but it was not suitable for infants. From each pound of dried beans used, 1¾ pounds of the wet bean residue was obtained.

It appears that dried beans as a food class supply minerals in sufficient quantity to meet dietary needs. Soybean contains an adequate supply of calcium, the most important of the minerals for children. It may also be assumed that these minerals also would be found in the soybean milk-substitute.

Dried beans also are adequate sources of vitamins A and B but are lacking in C and G. Egg is also a good source of calcium and the vitamins A, B, and G. Vitamin C is lacking. No means was found for supplying vitamin C for the small children. However, adults and children over a year to a year and one-half ate the green potato leaves after they were cooked.

FORMULAS

SOYBEAN MILK

(a) Grind 1 pound of dried soybeans to remove integument.

(b) Dry beans 1 hour in the sun.

(c) Soak beans 1 hour in 1 gallon of water.

(d) Grind the wet beans and add soakage water.

(e) Strain beans through cheesecloth and keep fluid part.

(f) Extract bean residue a second time with 1 gallon of water and repeat step "e."

(g) Add fluid portions "e" and "f."

(h) Dilute "g" further with another 1 gallon of water.

(i) Bring the resultant fluid to a boil.

(j) Allow to cool to a suitable temperature to drink and add 1 pound of sugar for taste.

EGG MILK

(a) Mix 1 pound of dehydrated egg powder with sufficient *cold* water to make a smooth paste. Gradually add more cold water sufficient to make 2 gallons of solution.

(b) Add ¾ pound of sugar.

SOYBEAN-EGG MILK

(a) Make soybean milk as in first recipe without sugar.

(b) Mix egg powder as in second recipe but without sugar.

(c) Mix "a" and "b." Be sure "a" is cool enough so as not to coagulate "b."

(d) Add 1¾ pounds of sugar.

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Addenbrooke, Edward F., Commander (MC) USNR (*Streamlined Foot Baths*, p. 602). A. A., Lewis Institute, 1919; B. S., Northwestern University, 1922; M. D., Northwestern University Medical School, 1924. Pathology service, 1924–25, intern, 1925–26, associate dermatologist, 1935–42, and associate in roentgen therapy, 1936–41, Cook County Hospital, Chicago, Ill.; instructor in pathology, 1924–28, instructor in surgery, 1928–30, and instructor in dermatology and syphilology, 1930–33, Northwestern University Medical School; instructor in dermatology and syphilology, 1934–39, and associate, 1939–, Loyola University School of Medicine; senior dermatologist, Henrotin Hospital, Chicago, 1935–; staff, St. Luke's Hospital, Chicago, 1935–. Fellow American Medical Association; member: Illinois State Medical Society, Chicago Medical Society, Society of Investigative Dermatology, and American Academy of Dermatology and Syphilology.

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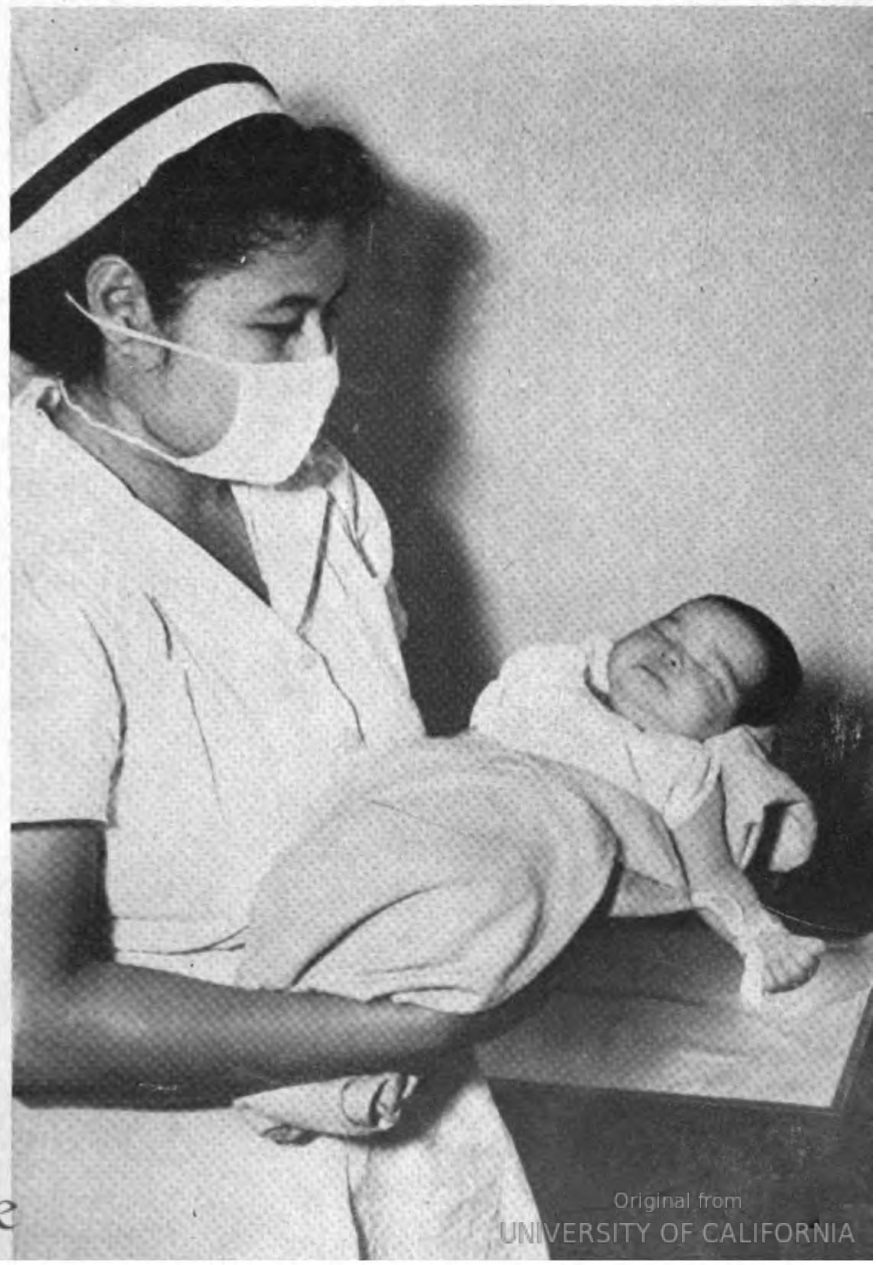
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COVER PHOTOGRAPH

A Navy-trained native nurse cares for a healthy, 8-pound baby girl in the U. S. Naval Military Government Hospital on Guam. The establishment of this hospital soon after American reoccupation of the insular possession has been a major factor in restoring the Chamorros' morale, which was all but crushed under the heel of Japanese domination.

—Official U. S. Marine Corps Photo.

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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

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PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researchers, observations, or experiences of individual medical officers.

With the establishment of the Dental Corps in 1912, the function of the BULLETIN was broadened to serve in a similar capacity for members of that Corps.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

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Contributions to the BULLETIN should be typewritten, double-spaced, on plain paper and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication; for example, addresses and dates, not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in headings and captions.

Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

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All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

LOUIS H. RODDIS, *Editor*,
Captain, Medical Corps,
United States Navy.

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U. S. NAVAL MEDICAL BULLETIN

VOL. 46 MAY 1946 No. 5

SPECIAL ARTICLES

MEDICAL ASPECTS OF BLAST

EDWARD LYMAN COREY[1]
Commander H(S) U. S. N. R.

Much yet remains to be known about blast and its effects upon the human body, but when one considers that intensive research in this field did not begin in the United States until after our entry into World War II, it must be acknowledged that a creditable amount of work was accomplished—at least so far as the solution of our more pressing problems was concerned. With the development of new explosives and other means for the rapid release of energy, we are confronted with the necessity for still further related studies. However if the present excellent cooperation continues to exist between ordnance, engineering, and medical facilities, both military and civilian, these newer problems should meet with ready solution.

The term "blast" has been used to identify the intense sound wave emanating from a detonated explosive. It has been rather loosely used in the past, and some investigators have even referred to the vibration of a steel deck caused by near-misses as "solid blast." This effect, so productive of os calcis fracture among Naval personnel, is by no means a blast effect, any more than the transmission of a blow through any solid structure is due to "blast." The effects of ground shock are often attributed to blast, and such loose usage of the term has resulted in much widespread misconception. Thus the breaking of windows many miles from the site of an explosion is often attributed to "air blast" in instances where the vibration of buildings due to ground shock was solely responsible. As a result, the term "blast" now encompasses true air blast, underwater concussion, transmitted

[1] Now Assistant Professor of Physiology, University of Virginia Department of Medicine.

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impact through hulls, ground shock, and the after-vibration of walls and other structures.

It is suggested that the term "explosion pressure" would be more precise. Thus one may refer to "explosion pressure in air" or "explosion pressure in water" while using the expressions "ground shock," "impact transmission through solids," and similar terms wherever they may convey the most precise meaning. Among ballisticians the term "chamber pressure" is in universal use. It connotes the peak pressure in pounds per square inch generated by an explosion confined within the chamber of a gun. Similar physical factors operate when a charge is detonated in the air or under water, except for the absence of confining walls. In the case of explosions within confined spaces, as when a delayed-action bomb is detonated below decks aboard ship, the analogy between blast pressure and chamber pressure is complete, the ship's compartment being comparable to the chamber of a gun in all ways with the exception of size. "Explosion pressure" would therefore appear to be accurate and clearly descriptive.

HISTORY

It seems certain that blast casualties have occurred in battle since the invention of gunpowder. Even before the use of high explosives such as TNT and RDX, this type of fatality undoubtedly was seen, though, as today, but rarely. The death of the soldier without discernible marks on his body was attributed to the "breath of the cannonball," the popular supposition being that the rapid rush of air close to the missle was in some way deadly. It is to be doubted, however, that many of these cases were truly the result of blast injury, but were probably caused by the entrance of very minute fragments into a vital area. Experience in World War II has taught us to examine casualties with great care in a search for minute entrance wounds, because very small fragments (but a few milligrams in weight), if traveling at sufficient velocity, may cause serious or even fatal wounds. Small stones and debris thrown up by an explosion may have an effect almost as lethal as fragments of the shell casing itself. Hence it appears probable that many deaths attributed to mysterious causes were actually, as now, the result of penetration by minute, high-velocity fragments.

A search of the literature indicates that Hooker (*17*) first reported upon the effects of gun blast on animals in 1924. He found pulmonary tissue to be particularly susceptible to injury. All interest in the subject then apparently lapsed until the Spanish Civil War when blast casualties were again encountered and were the subject of articles by Haldane (*16*) and by Kretzschmar (*18*). The mass bombing of British cities in 1940 marked the beginning of an earnest and detailed

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study of this type of casualty. The first published report of underwater blast injury was contained in a paper by Atkins in 1940 in which casualties from the Dunkirk evacuation were discussed. In the United States medical interest in underwater blast pathology may be said to stem from the sinking of the *Reuben James*. The study of blast injury was initiated in this country by the Navy Department early in 1942.

THE NATURE OF BLAST

A blast wave originating from an explosion is a phenomenon coming under the general subject of hydrodynamics, which treats of a disturbance in a fluid or gas. Blast may be defined as the compression (and in air, suction) wave which is set up by the detonation of an explosive. The wave of detonation travels through high explosives at from 15,000 to 30,000 feet per second, the time of detonation varying from 0.0004 to 0.0006 second for small to large bombs. For all practical purposes, therefore, one may consider detonation to be instantaneous. The potential energy of explosion has been calculated as 2.5 million foot-pounds per pound of high explosive employed. One cubic foot of TNT generates about 1,000 cubic feet of gas, but because of the high temperature the gas volume is in the neighborhood of 12,000 cubic feet per cubic foot of explosive. These figures would be much higher (approximately 50 percent) for the powerful mixtures such as Torpex.

Little is known concerning the forces generated very close to the charge, because in this area (the "zone of brisance") recording devices of whatever nature are literally blown to pieces by the disruptive effect of the explosion. Thus the crater may be said to demark this zone of brisance. It will be apparent that medical interest regarding blast effects in this area is nil, as a person within the brisant zone is either disintegrated by the explosion or receives multiple fatal hits from casing fragments.

A blast wave in air is composed of a pressure, followed by a suction component. The suction component is of much longer duration than the compression phase. Thus the duration of the compression phase has been estimated at 0.006 second and the suction phase at 0.03 second (*37*). The positive phase may exert pressures measured in hundreds of pounds per square inch (close to the charge), whereas the negative pressure can never exceed 15 pounds per square inch, since this corresponds to a perfect vacuum. The velocity and duration of either phase are such that the body of a man would be completely immersed for an instant in a wave of almost uniformly altered pressure.

A blast wave is, physically, simply a very intense sound wave. Thus, although the velocity with which the blast travels close to a

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charge varies with the "power" of the explosive (volume of gas produced multiplied by heat generated) it is quickly reduced to the speed of sound, and decreases in pressure as the square of the distance. This is true of blast waves generated in either air or water, and indeed of the rate of transmission of a blast wave through any material, including the human body. After the passage of the compression and suction phases, a third "oscillatory" phase follows which gradually decreases in intensity. Pressures produced during this vibratory phase are of such low magnitude that they may be ignored from a medical viewpoint, although their effect may be considered in damage to walls and structures.

Since a blast wave is essentially an intense sound wave, its velocity varies with temperature. About 1,100 feet per second may be taken as an average figure in air. In water its velocity approximates 4,800 feet per second, and peak pressures generated are much more severe than in air. As the human body is about 75 percent water, the blast wave will traverse the tissues at over 4,000 feet per second. As in air, the "shock front," or compression wave, is of sufficient thickness to impose uniformly elevated pressures on all parts of the body of swimmers or divers simultaneously. This point is well exemplified by the fact that crusher gages placed back to back will give identical readings following an underwater explosion.

Blast pressure is profoundly affected by the nature of the surrounding terrain. Thus, its intensity is greatly diminished within depressions such as foxholes, trenches, and ditches, and directly behind trees, bunkers, and walls. On the other hand, the blast wave is reflected from vertical surfaces, theoretically increasing the peak pressure by 100 percent. Actually the pressure caused by "reflectance" falls slightly short of this figure. Reflectance from the ground, cliffs, and walls of buildings; and under water, from the shoreline, hulls of vessels, and from docks and pilings may produce many almost unpredictable variations in pressure. In water, temperature gradients between the surface and the bottom distort the "shock front" and cause it to curve toward the colder strata. Hence, with a surface temperature above that at the bottom of even shallow water, the shock front is very perceptibly "bent" toward the bottom, rather than traveling in a straight and horizontal direction. When these variables are introduced, the "freakish" and almost unpredictable results of a blast may be understood.

MEASUREMENT OF EXPLOSION PRESSURE

Blast is at present best recorded (*37*) (*38*) by the use of piezoelectric gages in which the currents generated by the distortion of a

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suitable crystal deflect the electronic stream in a cathode-ray oscillograph. In such instruments inertia is eliminated, and when calibrated, they will accurately record not only peak pressures, but also the duration of the various phases of the blast wave. Indeed, photographic records made by the aid of such devices yield a true "picture" of pressure changes throughout the passage of the positive, negative, and oscillatory phases of blast. However, for practical use in the field these gages are seldom employed. This is largely due to the fact that usually a large number of pressure readings are desired at various distances and directions from the charge, and also because the older types of gage are more easily set up and greatly simplify the necessary installations and equipment. Moreover, the loss of or damage to piezo-electric equipment would be a much more serious matter than is the accidental destruction of the more simple types.

The Williams gage remains the instrument with which air blast pressures are most commonly measured in the field. This gage is composed of a brass cylinder and aluminum alloy plunger. The distance which this piston is moved by the blast is recorded as the peak positive pressure. The inconsistencies in readings and inaccuracies of blast measurement by means of this instrument are well known, but for the reasons cited it remains the one most commonly used in field experimentation.

Diaphragm gages were experimented with by both the Navy and Army. Such gages operate on the principle of membrane rupture—the smaller the membrane area, the higher the blast pressure required to rupture it, providing all membranes are of a homogeneous material, unaffected by humidity and other variants. Like the Williams gage, such instruments will record only peak, positive pressure.

In measuring underwater blast pressure, the simple crusher gage remained in common use throughout the war. In this instrument a steel piston is driven against a standardized copper ball, producing an indentation of its surface. Micrometer measurement of the ball then permits an estimation of the peak pressure to be made. As with the Williams gage, several "crushers" are commonly placed together and an average of the readings is taken as the true pressure. From the standpoint of medical research, the principal fault of the crusher gage lies in the fact that it will not operate at "low" pressures, the lower limit being about 300 pounds per square inch. Even here the readings are inaccurate, as the gage is designed to record much higher blast pressures.

Hillier gages may be used in underwater work. Here a series of pistons of varying weight are forced back against a series of springs. With very high peak pressures, it is thus possible to obtain a curve

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representing the almost instantaneous rise to peak pressure, with more gradual decline to the base line with the passage of the shock front.

None of these more rugged and simpler gages is, of course, comparable in accuracy to piezo-electric equipment, as only the latter can give a true picture of the magnitude and duration of the pressures produced by a blast. The future will doubtless see the employment of piezo-electric gages the rule rather than the exception, multiple installations being placed in mobile carriers to facilitate their use in the field.

AIR BLAST

Animal Experiments

The first animal experiments on the effects of air blast were carried out in 1924. Little more was known until the first articles from England (*37*) (*39*) began to appear with the outbreak of war. The first investigation of the effects of air blast on animals to be undertaken in the United States was begun by the Navy in September of 1942, when rabbits, guinea pigs, and monkeys were exposed, at varying distances, to the blasts from large charges of a high explosive. All observers have been in complete agreement on certain fundamental pathologic findings, so that one may consider the major pathosis of blast as definitely known and well established.

The single type of lesion uniformly present is "bruising and rupture of the lungs" (Hooker). Pulmonary damage may be either slight or severe, depending upon the magnitude of the blast pressure. Thus lesions may vary from small punctate areas to massive hemorrhage with hemothorax. The cause of this type of injury is the positive phase of the blast, although similar lesions may be caused by explosive decompression (*19*). That is to say, since the suction wave is present for but a fraction of the time taken for even a very fast expiration, negative pressure cannot be the major causative agent of injury, although it may conceivably add to the damage produced by the compression wave. Furthermore, experience with explosive decompression in man (aviation medicine) indicates that decompression in air, even at rapid rates, is relatively harmless. Although the pulmonary lesions are those most commonly encountered, there is no doubt that sufficiently elevated pressures may produce rupture of the gastro-intestinal tract.

That air blast *per se* is ineffective at any considerable distance from even large charges was effectively shown in an early Navy experiment in which 1,750 pounds of TNT were detonated. Rabbits and guinea pigs 100 feet distant from the charge were entirely uninjured, as shown by their general condition and x-ray examination, as well as by gross and microscopic pathologic study. This result confirmed

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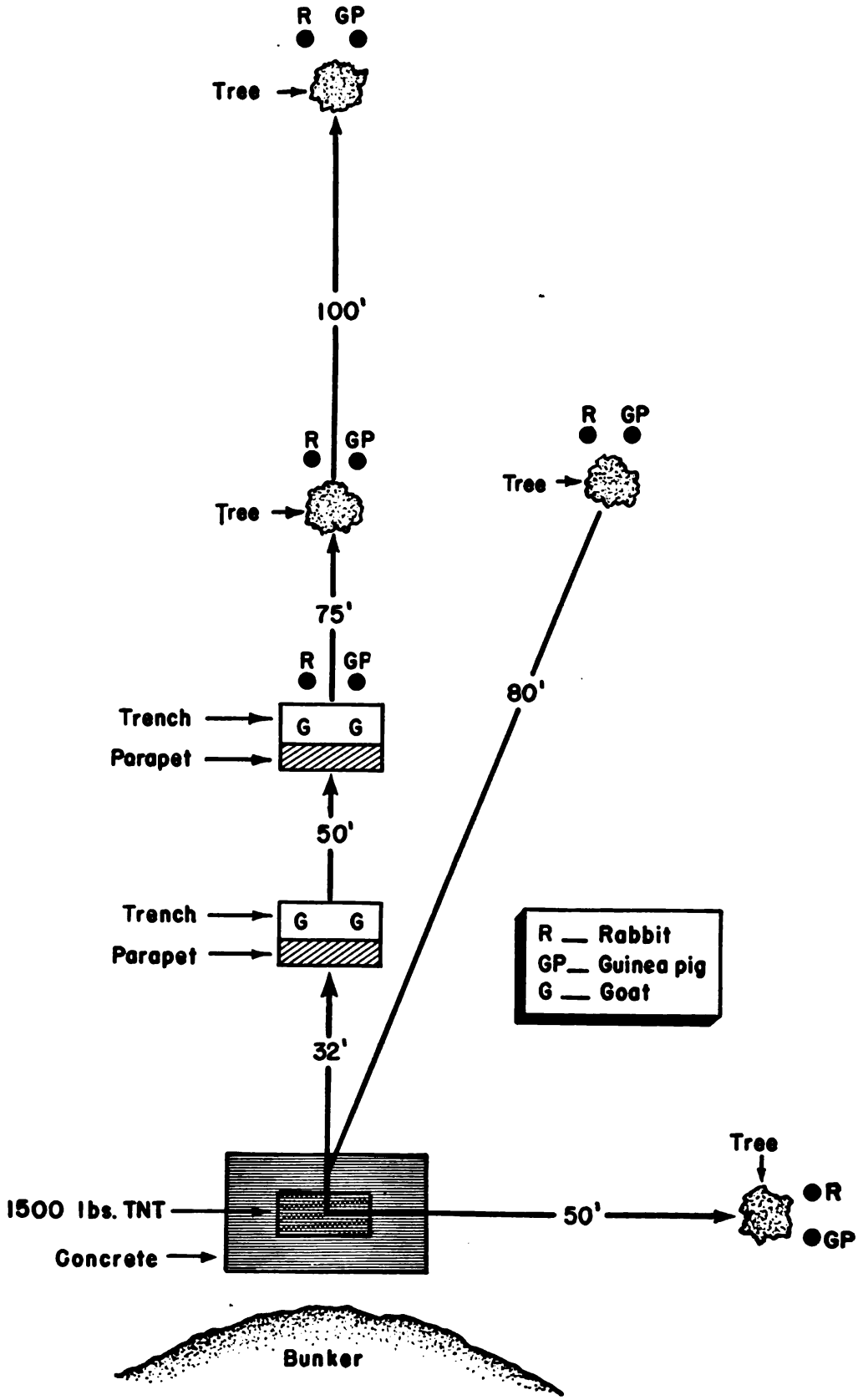
the findings of British observers (*37*) who exposed mice, rats, guinea pigs, rabbits, cats, monkeys, and pigeons to the detonation of 70 pounds of TNT. None of these animals at distances beyond 18 feet was injured in any way. Thus, although the dangers of air blast injury had been pointed out by Fulton (*11*), Hadfield et al. (*14*), O'Reilly and Gloyne (*21*), Dean et al. (*7*), and others, it appeared in late 1942 that air blast injury, of itself, did not constitute a sufficiently grave military hazard to warrant the adoption of protective measures, frequently recommended, at least until detailed studies of a large number of blast casualties should indicate beyond doubt that such measures were necessary.

Tabulation of Navy air blast experiments

(Charge: 1,500 lbs. TNT)

Animal	Distance from center of charge (feet)	Conditions of exposure	Result
Guinea pig	32	Behind tree	Killed.
	50	Behind parapet	Killed.
	50	Behind tree	Died within 24 hrs.
	50	Behind tree (in long axis of charge)	Survived.
	73	Behind tree	Died within 24 hrs.
	75	Behind tree	Survived.
	80	Behind tree	Survived.
	100	Behind tree	Survived.
	100	Fully exposed	Survived.
	100	In fox-hole	Survived.
	140	In shelter	Survived.
	147	Fully exposed	Survived.
	147	In fox hole	Survived.
	150	Fully exposed	Survived.
	150	In fox hole	Survived.
	200	Fully exposed	Survived.
	220	Fully exposed	Survived.
	220	Behind barricade	Survived.
Rabbit	32	Behind tree	Killed.
	50	Behind parapet	Killed.
	50	Behind tree (in long axis of charge)	Survived.
	58	Behind tree	Killed.
	73	Behind tree	Died within 24 hrs.
	75	Behind tree	Survived.
	80	Behind tree	Survived.
	100	Behind tree	Survived.
	100	In fox hole	Survived.
	140	In shelter	Survived.
	147	Fully exposed	Survived.
	147	In fox hole	Survived.
	150	Fully exposed	Survived.
	150	In fox hole	Survived.
	200	Fully exposed	Survived.
	220	Fully exposed	Survived.
	220	Behind barricade	Survived.
Goat	32	In trench	Killed.
	32	In trench (kapok protected)	Killed.
	50	In trench	Killed.
	50	In trench (kapok protected)	Killed.
	140	In shelter	Survived.
	140	In shelter	Survived.
41 animals	32 to 140	Various	All survived at distances greater than 75 ft.

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1. Design of Navy air blast experiments on protection afforded by terrain.

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These results were further borne out by the Navy experiments of 12, 21, and 23 September, and 10 October 1942. In these tests, further exposures of animals to large charges were carried out. In still other trials, rabbits, and goats were placed within earth and log shelters in close proximity to blasts, and the ineffectiveness of shallow-water mines in producing injury to large animals placed within assault craft was also demonstrated. Thus Naval medical opinion came to regard air blast as a minor and infrequent hazard (accompanying table and fig. 1).

The Norfolk Blast

On 17 September 1943, a blast occurred at the Naval Air Station, Norfolk, Va., resulting from the accidental detonation of several Torpex depth charges. The physical damage testified to the intensity of the blast, several buildings being completely demolished and structures damaged at distances of from 300 to 400 yards. A detailed examination of 55 casualties followed. No cases of "blast injury" were encountered, and none of the men exhibited any diagnostic symptoms such as bloody sputum, pulmonary dullness, chest pains, or respiratory embarrassment. Findings of chest x-ray examinations were also negative. No injuries to the eyes or ears were reported *other than those resulting from missiles*, and no eyeground pathosis was noted. Attending surgeons reported no chest pathosis uncomplicated by shrapnel penetration, and that where intestinal perforation took place, at least one missile had entered the abdominal cavity. There were 94 injuries in the 55 patients. The location and type of wounds are tabulated as follows:

	Percent		*Percent*
Fractures	23.5	Thorax	10.6
Head	14.9	Eye	2.2
Legs	14.9	Burns	7.4
Arms	13.8		
Abdomen	12.7		100.0

It is not definitely known at what air blast pressure the human tympanum may be ruptured. Available data are based on the accidental detonation of charges in instances where the victim happened to be standing close to a gage of the Williams type. In one such instance the gage reading was 10 pounds per square inch, but in another case, in which a reading of 12 pounds per square inch was recorded, the tympanum remained intact. The time-honored figure of 7 pounds per square inch as being "about all the pressure a man can stand" would thus appear fairly accurate, at least as regards blast in air.

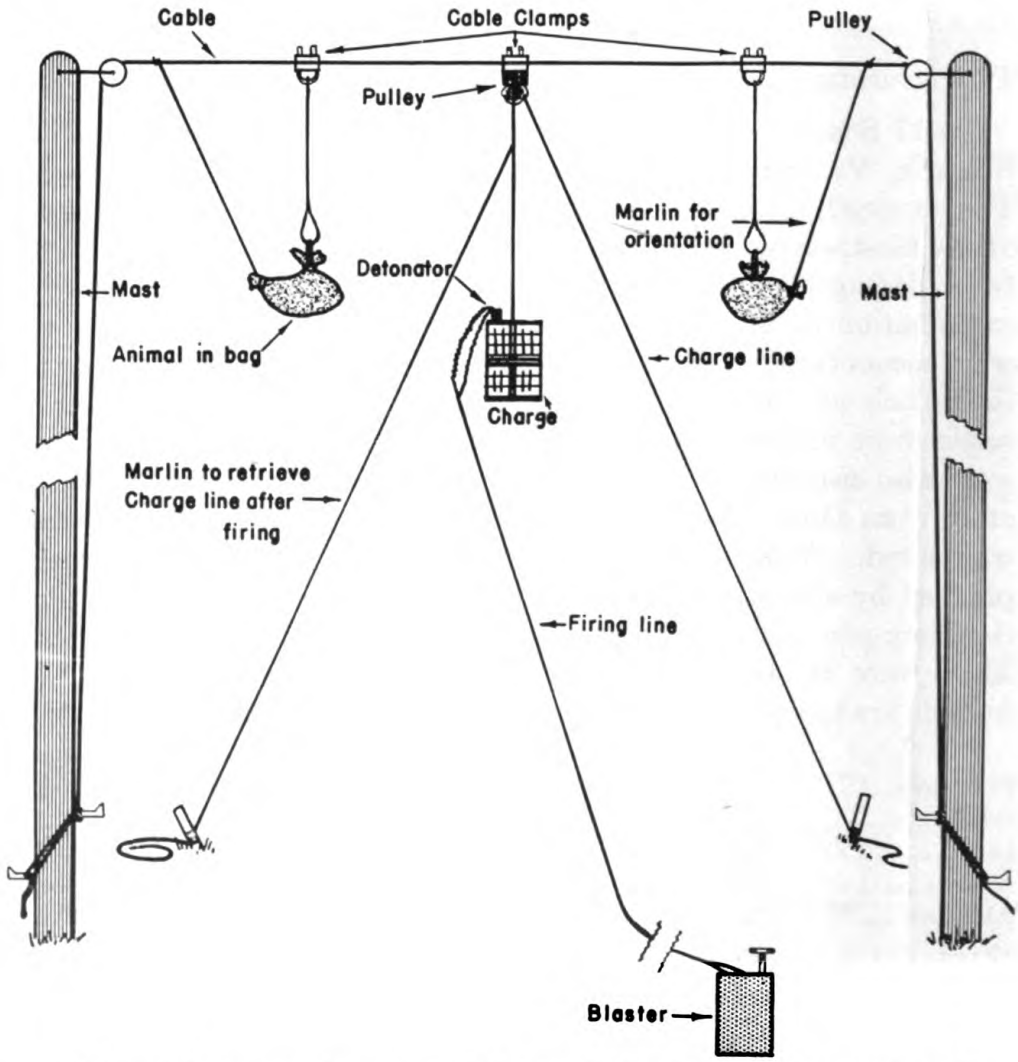
All of the Norfolk patients who could be interviewed, estimated the distance from the explosion at which they stood at from 25 to 100 feet. Several men were so close to the blast as to receive third-degree

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burns of the face, without any evidence of injury by blast *per se*. From careful study and tabulation of these cases it was concluded that:

1. "Blast injury" is probably not a major factor in producing injuries from large bomb explosions, inasmuch as no recognizable cases of "blast lung" were observed following the Norfolk disaster.

2. Such explosions produce terribly mutilating injuries from missiles as well as burns ranging from first to third degree.



2. Plan of Navy experiments on air blast, eliminating shell fragments and reflectance.

Following this experience the Navy decided to perform further tests in which animals might be exposed to bare charges, completely eliminating missiles, and that particular attention should be paid to blast injury in relation to the extent of the flash area. Further, that a complete neurologic study be undertaken in an attempt to ascertain whether lasting damage to the central nervous system might follow exposure to

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blast. The results of these tests were reported on 24 June 1944. The distance between the experimental animals and charge was in all cases less than that between the charge and the ground, in order that all "reflectance" might be eliminated. Charges of from 0.5 to 20 pounds of TNT were used, with tetryl booster. The animals were suspended in muslin or burlap bags (simulating clothing) so oriented as to face the charge (fig. 2).

From these experiments it was concluded that:

1. Injury . . . does not occur when experimental animals are just outside the flash area, but it is a constant finding when they are within the flash area and are burned.

2. Microscopically demonstrable changes may occur in the central nervous system following exposure to air blast under extreme conditions; these changes were visible in only two animals out of a series of seven studied (for central nervous system pathosis), and were not marked. Depression of the central nervous system occurs, but this may be transient.

3. . . . Air blast does not appear to be a serious military hazard.

This closed the subject of air blast *per se* as a casualty-producing agent so far as the Navy was concerned, and no further work was done along the lines of protection. It will be noted, however, that all of the instances referred to apply to blasts in the open, and that no studies have thus far been undertaken concerning the effects of blast upon personnel within confined spaces. This should be investigated, inasmuch as explosions below the decks of Naval vessels due to delayed-action projectiles, or indeed any projectile not employing a contact fuse, will often result in just this condition—a powerful blast confined by steel bulkheads. Field observations also indicate that the effects of blast at various heights above ground might bear study.

Gun Blast

The effects of gun blast upon ship structures and equipment (*14*) have long been studied by the Navy, and more recently there has been considerable interest in the effects of gun blast upon personnel. The areas about various types of guns at which 7 lbs. per sq. in. is attained have been carefully delineated and these pressure plots are considered in the placement of gun crews and topside personnel. Particular attention has been paid to blast pressures at ear positions.

Because of gun blast, the problem of the so-called "ear-defenders" has long been studied in an effort to procure the best possible materials and design for ear-plugs. The problem is complicated by service conditions, because, while blast must be minimized, verbal orders must be clearly detected, and any device of this nature must be small, instantly available, disposable, or simply and quickly sterilized. Furthermore, the material must be one which will not produce skin

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reactions or inflammation of the meatus. Comfort is a primary consideration; without this feature such devices will not be worn by the men under any condition. In tropical theaters, fungous infection following the irritation of the meatus by the use of ear-plugs has further complicated the problem.

Audiometry has conclusively shown that tinnitis and deafness after exposure to gun blast is reduced by the use of any type of ear-plug, and the Navy's "V–51" defender of neoprene with metallic insert has been thus far concluded the most efficient of these devices. On the other hand, absorbent cotton, of long tradition among gunners, possesses the advantages of a fair degree of protection, cleanliness, availability, simplicity in use, and is disposable and non-irritating. It is also comfortable, light, and eliminates the necessity for washing and sterilization. Therefore, while the specially-designed ear-defenders undoubtedly provide more efficient protection, the familiar absorbent cotton will probably maintain its traditional post at gun positions for some time to come.

UNDERWATER BLAST

During World War II underwater blast has been a far greater producer of casualties than has blast in air. This is due to the greater intensity of an underwater concussion for a given weight of charge, and to the fact that the sinking of a Naval vessel is often accompanied by explosions aboard or by the detonation of armed depth charges. Since these explosions may take place in close proximity to a large number of immersed personnel, the occurrence of a relatively large number of casualties becomes unavoidable.

Early in 1942 Breden et al. (*3*) reported the clinical histories of ten victims of underwater blast produced by torpedo and depth charge explosions, and in the summer of that year the Navy began experiments in this country (*13*). The results of the Navy study are in almost entire agreement with the findings of all later investigators in this field of pathology. Animals of all sizes were used, from rats to goats, and experimentation was extended from small-scale tests to the simulation of actual conditions at sea. The pathology as described by Greaves and his associates may be considered typical of this type of injury in all details.

Gross pathology.—In cases of severe injury the lungs are characterized by diffuse hemorrhage throughout the entire parenchyma, very little aerated pulmonary tissue remaining. Free and clotted blood is found in the air passages, and occasionally there may be laceration of the visceral pleura with secondary hemothorax. Subpleural hematomas are sometimes encountered, in some of which small blebs of air may be seen. Hemorrhagic discoloration of the lungs is not uniform. The outlines of the ribs and intercostal spaces upon the pleural

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surface are prominent, particularly so in larger animals. Some disagreement exists as to whether the hemorrhagic stripings represent the impact of the ribs or the transmission of pressure through the intercostal spaces.

In the gastro-intestinal tract lesions are primarily of two types—complete perforation of the wall and hemorrhagic discoloration of the wall. No lesions occur in the mesenteric attachments (at least in small animals). These lesions may occur in all portions of the gastro-intestinal tract from stomach to rectum and are invariably and definitely related to the presence of gas within the lumen. In the guinea pig the fundus of the stomach, cecum and lower ileum are particularly vulnerable. The perforating lesions are usually associated with little interstitial hemorrhage and with no hemorrhage into the lumen, thus giving the lesion the appearance of a sudden disruption of the wall from within outward. Not all animals receiving fatal blast injuries show intestinal lesions (*13*).

Sublethal charges produce similar but less extensive damage, and areas of pulmonary hemorrhage are more localized. Pleural laceration is absent and bleeding into the air passages less severe. Gastro-intestinal lesions are fewer and smaller in size. Minimal lesions in the lungs are small and few in number. They are frequently symmetrical and marginal, involving the antero-inferior edges.

Greaves et al. summarize the gross pathology of underwater blast by stating that "pulmonary lesions were always found if any injuries resulted from the blast," but that "intestinal lesions were quite inconsistent in occurrence." No other organs or tissues showed injury, but a few fractured extremities resulted from high-order explosions when animals were placed close to the brisant area.

Microscopic pathology.—The first evidence of minimal lesion is rupture of the capillaries and hemorrhage into the interalveolar septum with separation of the two epithelial layers. Extravasated blood apparently dislodges the alveolar epithelium and finds its way into the alveolar spaces. In more serious injury the interalveolar septa as well as the capillaries are ruptured and destroyed with direct hemorrhage into the air spaces (traumatic emphysema).

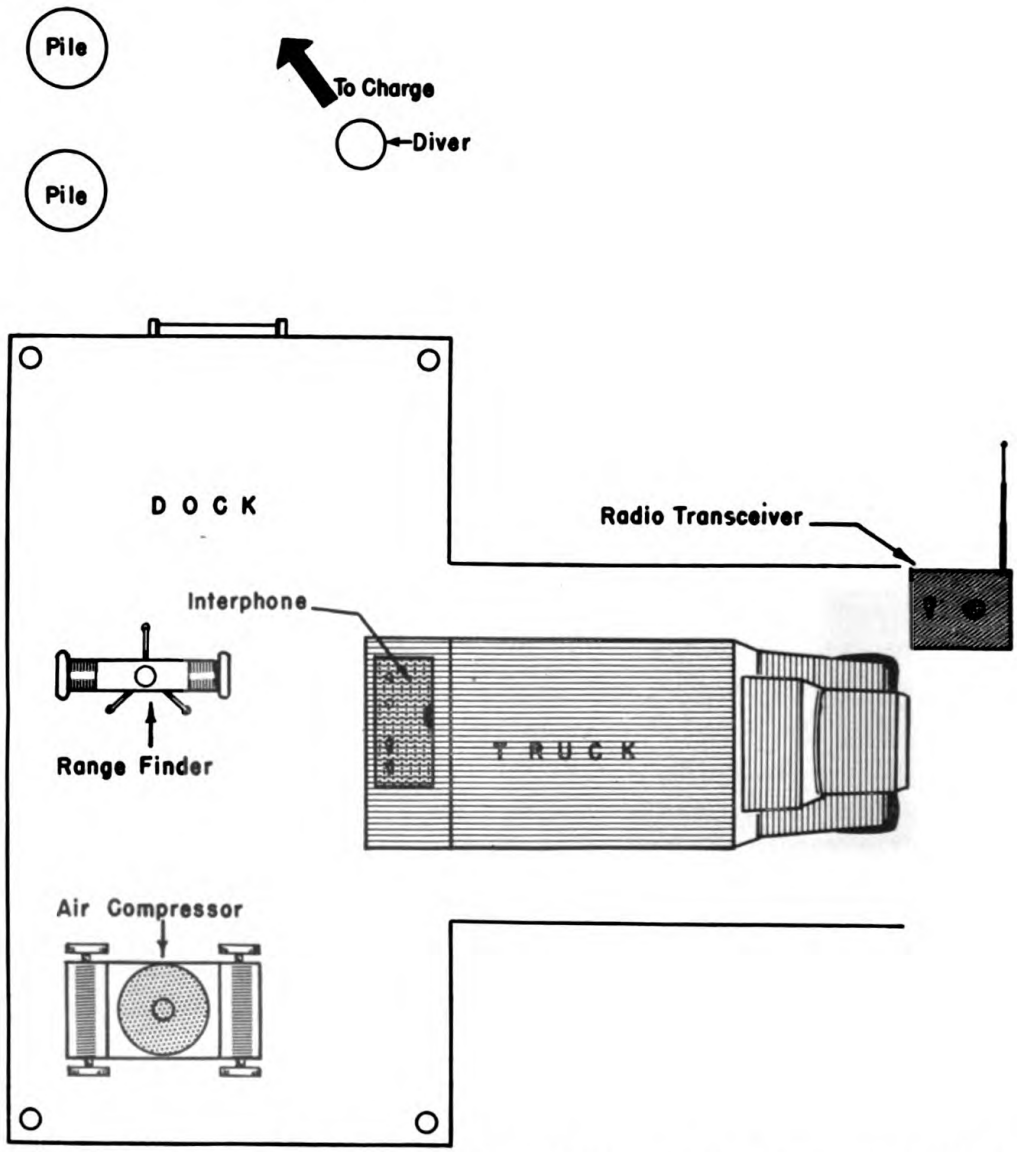
In the gastro-intestinal tract, hemorrhage is chiefly into the mucosa and submucosa. In perforating lesions the intestinal tissue around the tear is thin and shattered, "resembling tissue that has been crushed" (*13*).

When the head of an animal is immersed, coincident with a detonation, epidural and subdural hemorrhage occurs and skull fracture is not uncommon.

The chief point of interest in underwater blast injury is the fact that the only lesions uniformly found by all investigators are in *those*

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structures containing gas; i. e. the lungs, gastro-intestinal tract, and bony sinuses. This indicates that blast is only effective at the interface between a fluid or tissue and gas or air. The phenomenon may be compared to that taking place on the surface of the sea directly above an exploding depth charge. Here the concussion wave traveling outward from the charge produces a "doming" of the surface with a shredding effect, the surface of the water being "blown off." This is followed by the geyser of gas and water thrown up at the time that the expanding gas bubble reaches the surface. This latter, more spectacular event is, of course, harmless as compared to the compression wave or "shock front."



3. Experimental set-up in determination of deterrent blast pressure for divers (shallow water).

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Motion pictures obtained by the Navy at a rate of 1,000 frames per second have shown conclusively that intestinal strips containing saline solution remain undamaged by underwater explosions, even when quite close to the charge, whereas when very minute bubbles of air are present, immediate and frank perforation invariably takes place at the same range. Underwater blast injury is thus confined to certain definite structures—those containing gas. Clinical reports of injury to other organs have not been confirmed in well-controlled animal experimentation to date.

Deterrent and Lethal Explosion Pressures

Deep-sea divers.—Experiments (figs. 3 and 4) to determine the distances from the detonation of various sized charges at which deep-sea divers might work in safety were begun by the Navy in August 1942 and a complete report of all findings was made 14 January 1943. In this work a total of 46 charges, of from 1 to 300 pounds in magnitude, were detonated at distances varying from 168 to 3,627 yards. Calculated pressures to which the subjects were exposed were 4.3 to 55.4 pounds per square inch. The depth of water in which the charges were laid varied from 5 to 50 feet, and total depth from 12 to 102 feet. All divers were placed at 20-foot depth, either on a mud bottom, or on a stage, as in the deep-water experiments.

All pressures were calculated by the following formula, based on TNT:

$$p = 13{,}000 \sqrt[3]{\frac{\text{wt. charge (lbs.)}}{\text{distance (ft.)}}}$$

Calculation by formula was preferred to other methods of pressure determination inasmuch as practicality for field use was desired. Moreover the calculated pressures lend themselves readily to correction for estimate by any other method and for any type of explosive. During the progress of the work, pressure calculations were greatly facilitated by use of the Webster blast rule, a slide rule designed for the purpose. By means of this device, pressures at any distance from any weight of charge, or the proper distance for the laying of any charge to produce a desired pressure, could be rapidly and accurately calculated. The Bureau of Medicine and Surgery subsequently made this equipment available to the Bureau of Ordnance.

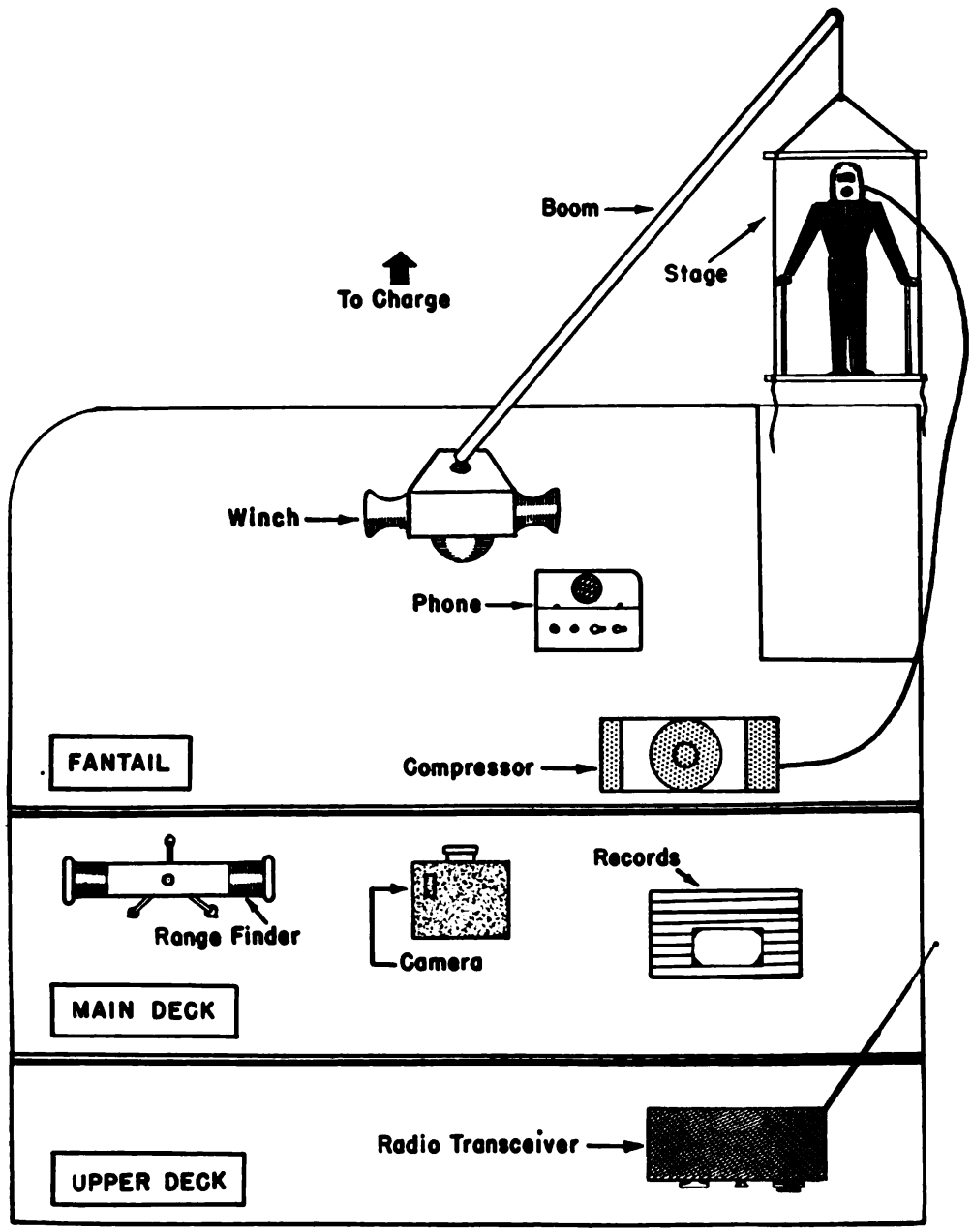
In all of the work with divers the subjects were instructed to so regulate their air supply that the dress pressed snugly against the legs and abdomen. After each explosion divers were questioned as to:

1. Sound: Description of the sound and its intensity; effect on the ears (pressure, pain, etc.).

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2. Pressure: Any sensation of pressure ("squeeze") upon the dress, and its location. Tendency to be displaced or thrown off balance, wave motion, etc. Jar or blow to the head due to its displacement within the helmet. Displacement of equipment (stage, lines, etc.). General sense of well-being and desire to continue the work at higher pressures.

The 10 divers used as subjects were exposed to concussion from charges of from 1 to 300 pounds in weight.



4. Experimental set-up in determining deterrent blast pressure for divers (deep water).

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Results.—In no instance did a diver suffer any demonstrable injury. During the work performed on a stage in deep water the divers' heads were at times thrown with different degrees of violence against portions of the helmet and breastplate, but in no instance was the blow to the head of sufficient violence to break or bruise the skin or render the subject dizzy, unconscious, or interfere in any way with prompt mental or physical reactions. Thus these 10 men, exposed on 46 occasions to calculated underwater explosion pressures of from 4.5 to 55.4 pounds per square inch, sustained no injuries whatever, and such exposures under the conditions prevailing in the experiments may be concluded to be entirely innocuous.

Psychic reactions were, however, observed in certain men following initial or early exposure to concussion. Thus in one instance a diver described sensations of concussion, faintness, feared he would lose consciousness and asked to be brought to the surface. Other men exposed on the same day to charges of even 10 times this magnitude at less than one-fifth this distance described no such sensations. Furthermore the diver who had exhibited the psychic reaction described was subsequently exposed to numerous charges, stating that there was "no pressure or feeling of vibration of any kind." On other occasions, when a man was first exposed to an explosion, a certain amount of anxiety was evidenced by changes in timbre of the voice, inquiries as to the magnitude of the charge to be detonated, or obvious relief on being brought to the surface.

On the other hand, certain divers never exhibited any tension and even pressed the head against the helmet at "stand by" in an attempt to accentuate any possible blow or concussion. Moreover, once accustomed to the work, all tension seemed to be dissipated, and the experiments were carried out in a routine manner. It may be added that those divers interviewed some time after the completion of the tests indicated a desire to "take" even larger charges, apparently out of curiosity as to the effect.

It was concluded that the amount of nervous tension exhibited by the subjects was no greater than might be expected in any unusual or unfamiliar situation.

Sound.—The sound of underwater explosion as heard within the diving helmet was described in similar terms by all of the subjects. However, there was a marked difference between the sound transmitted by charges detonated in shallow, as compared to those fired in deep water.

In shallow water (charge at from 5 to 12 feet, diver at 20 feet) the sound made by exploding charges was described as "like a pebble striking the helmet" or "a sharp crack" depending upon the size of the charge and its distance from the diver. When shallow-water diving

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equipment was used, with the ears in immediate contact with the water, the sound was described as merely a "swish." A peculiarity of the sound as heard in shallow water was its almost invariable double character described as "two distinct clicks" or "loud crack, the second one not quite so loud." This double sound was attributed to reflection of the blast wave from pilings about the dock and, more probably, the adjacent shoreline.

In deep water (102 ft.) the detonations sounded similar to explosions in air, but of a muffled character—"a heavy boom"; "a heavy, dull, muffled thud"; "a powerful, dull rumble"; "a heavy explosion."

Neither in shallow nor in deep water was the intensity of the noise itself unpleasant, nor was there any complaint of pain in the ears. It was concluded that the character of the sounds produced by underwater explosions, as heard by a diver, may differ widely, depending upon magnitude of charge, distance from charge, depth of water, character of bottom and the nature of adjacent objects, but that injury to the ears of divers wearing the standard Navy deep-sea dress may not occur at calculated explosion pressures up to 55 pounds per square inch.

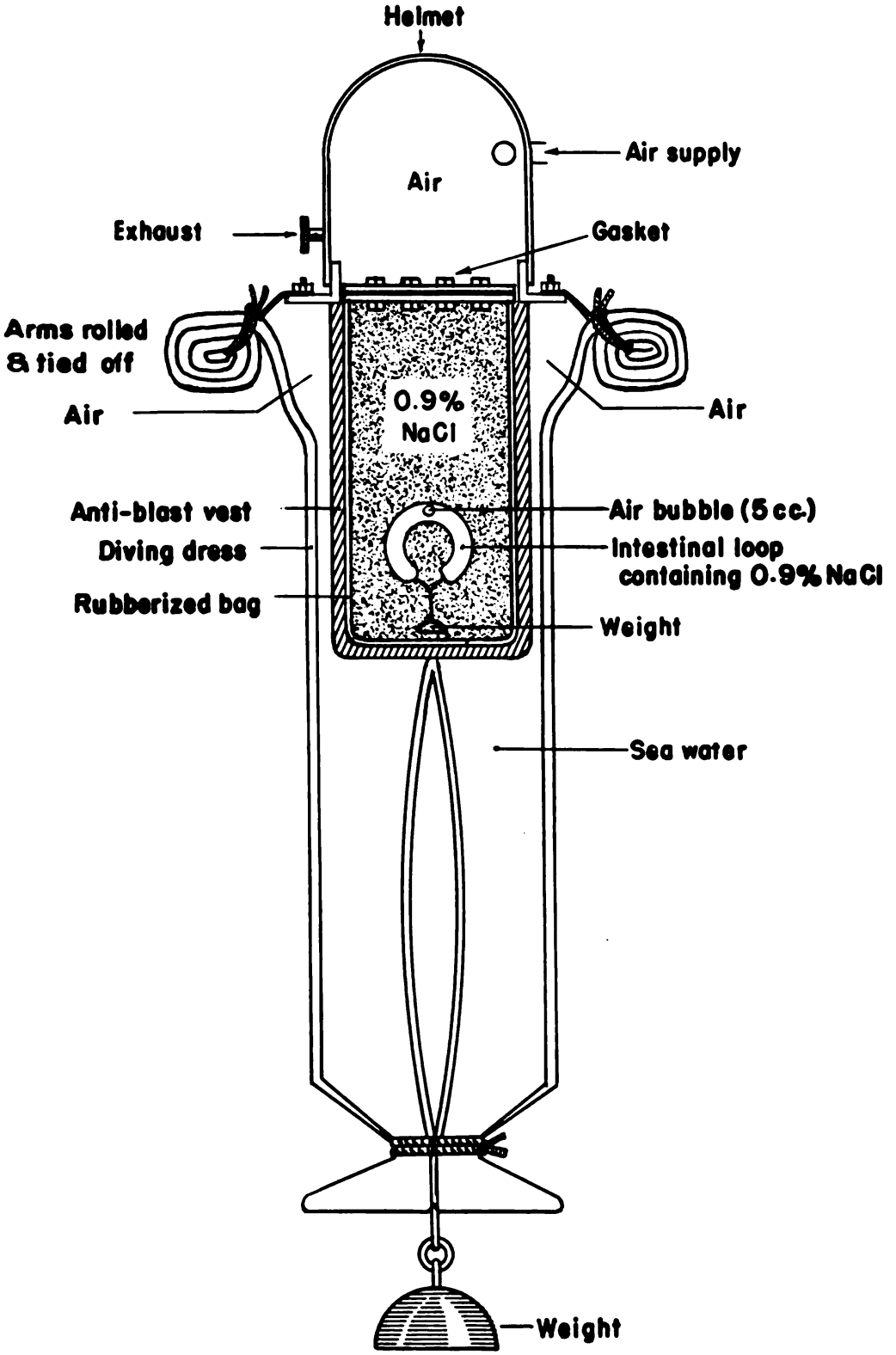
Pressure effects.—Reports of pressure sensations were, like those of sounds heard, necessarily subjective.

In the initial experiments in shallow water, the first sensation of "blast" was reported at a calculated pressure of 14.5 pounds per square inch when the driver described a feeling as of a "gust of wind going by." However, no similar sensations were described at a pressure of 18.2 pounds per square inch. At 16.4 pounds pressure another diver described a "rap" on the wrist which was again detected at 20 pounds. When calculated pressures of 30.4 and 31 pounds were reached, a feeling of slight pressure upon the legs was described, but the diver withstood a calculated pressure of 55.4 pounds per square inch in comparative comfort. Another diver reported a "very noticeable sense of pressure in the ears, with a momentary feeling of pressure on the body" at an explosion pressure of 49.5 pounds per square inch.

Practically, however, in the delineation of safe working-distances, one must consider the effects of various depths of water, character and conformation of the bottom, depth of charge below the surface, and reflection of the shock front from sloping and vertical surfaces. Hence to assure safety to divers, even with 100 percent reflectance (as from a vertical shelf or submerged hull) we may be certain that injury from underwater concussion will not occur if explosion pressures do not exceed 25 pounds per square inch, calculated.

It is true that 100 percent reflectance might even be exceeded under certain peculiar conditions, as would be the case with the charges

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5. Apparatus to determine efficiency of British anti-blast vest. Identical equipment, omitting the vest, was used as a control.

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placed at the center of a parabolic surface and the diver so located as to receive the reflected shock wave at its "focus." There is the theoretic possibility that such conditions could obtain in practice, as in the detonation of a charge within a parabolic cavity along a shoreline. This possibility, however, may be characterized as extremely remote.

From these experiments, which constitute the only data at present available, and which represent the only tests of this nature conducted in this country, the following definite conclusions were drawn:

1. Divers may be exposed to calculated explosion pressures up to 50 pounds per square inch without marked discomfort or injury.

2. The foregoing is true for charges of from 1 to 300 pounds in magnitude.

To complete our knowledge of the effects of underwater blast upon Navy divers and their equipment, further tests were later (January 1945) conducted to determine lethal blast pressures in deep-sea diving and to evaluate the resistance of British anti-blast diving vests and American deep-sea diving equipment to underwater concussion (fig. 5).

For the determination of lethal blast pressures, strips of beef intestine were used as test objects. The intestinal strips were filled with saline solution and 5 cubic centimeters of air were added to simulate a gas bubble. The reliability of this method had been proved in earlier Navy experiments. Furthermore, mechanical devices and artificial membranes later tested had been found impractical. To determine the lethal pressure for a man in Navy diving dress, a standard suit was filled with sea water to the level of the breastplate, with air-supply attached as in actual use. Sections of beef intestine were then suspended inside the dress at the level of the umbilicus by means of a weight and a cord attached to the chin-valve of the helmet. The whole apparatus was then lowered into the water and subjected to blasts from Mark IX (114 lb.) charges. The calculated pressure at which rupture of the intestinal sample occurred was considered "lethal."

In order to test the efficiency of the kapok anti-blast vest, a similar technic was used. Special rubber bags sealed by gaskets were constructed to simulate the human torso and so assembled that the blast vest completely enclosed such a bag, with intestinal strips properly located within.

The resistance of the standard Navy deep-sea dress alone was ascertained by exposing fully assembled, water-filled equipment to successively intensified blasts. The conclusions reached follow:

1. A calculated underwater blast pressure of 300 pounds per square inch may be considered lethal for divers wearing standard deep-sea diving dress.

2. The British anti-blast vest offers a measure of protection against

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underwater concussion, the "lethal" pressure being raised to at least 525 pounds per square inch.

3. A blast pressure of 1,000 pounds per square inch (calculated) approximates the limit of resistance of standard Navy deep-sea diving equipment to underwater concussion.

4. A diver exposed to underwater blast may suffer lethal injury at pressures producing no damage to his equipment. That is to say, the lethal pressure for a diver is approximately one-third that necessary to produce failure in the dress.

From the above it will be noted that, for the diver, the "lethal" explosion pressure (300 pounds per square inch) is of the order of six times the "deterrent" pressure (50 pounds per square inch), which means that a considerable safety factor is operating even at such short distances from charges that the "deterrent" pressure would be greatly exceeded upon detonation.

Pressures for immersed personnel.—In 1944 with the increasing use of underwater demolition units and the consequent hazard from underwater concussion injury to personnel, experiments were conducted by the Navy to determine what blast pressures might be considered lethal and "deterrent" for personnel immersed to the neck in shallow water. This was deemed desirable from the standpoint of personnel wading ashore from landing craft as well as to determine to what ranges demolitionists must retire before firing their charge.

At Fort Pierce, Fla., a group of 11 Naval officers approached detonating Mark V demolition charges (110 pounds) over a carefully surveyed and marked course. Six of these men wore swimming trunks only; one wore, in addition, an inflatable life belt ("destroyer belt"), and four were equipped with the standard Navy kapok life jacket. The water was 5 feet deep over a soft mud bottom, and the charges were detonated at a depth of 3 feet, being supported by floats. At "stand by" the subjects immersed themselves to the neck, with the feet just clear of the bottom, while orienting themselves by means of a rubber raft. Lethal pressure was estimated by employing samples of beef intestine filled with saline solution plus 10 cubic centimeters of air. These were immersed at 10-yard intervals over a course of 210 yards at 1- and 3-foot depths.

The results of the tests are of interest, as they constitute the only data available in this country obtained from the deliberate and controlled exposure of human subjects to underwater blast, with the exception of Navy divers. The findings may be summarized as follows:

Underwater concussion produces definite abdominal sensations at rather low pressures (22.5 pounds per square inch), but no impact of the shock wave against the thorax could be detected by any of the subjects. Abdominal sensation, however (borborygmus, shifting gas

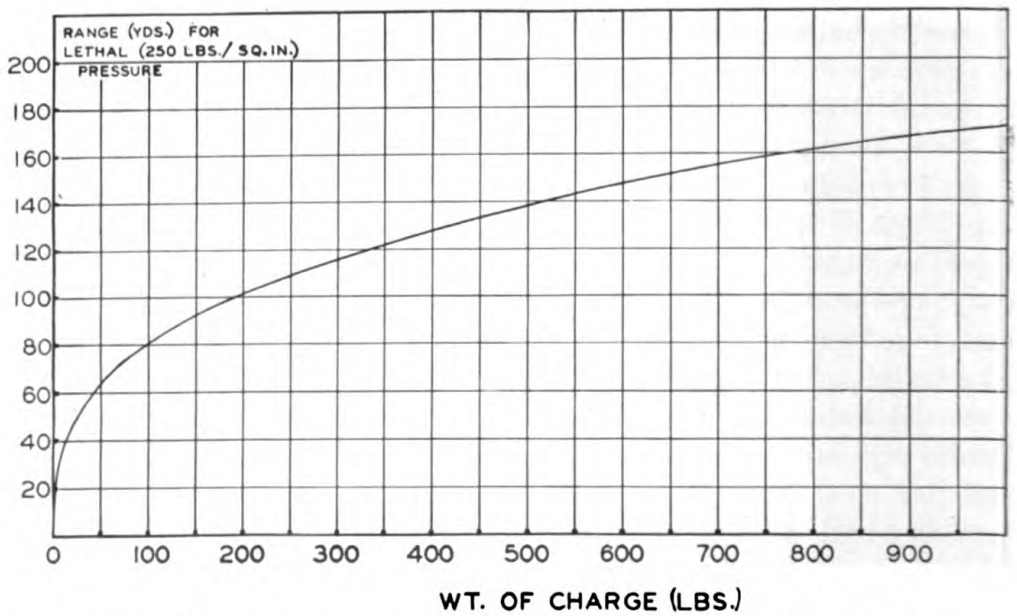
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bubble sensation, "somebody hitting you," "pressing as with the hand"), was uniformly present at calculated pressures from 22.5 to 69.2 pounds per square inch.

Aside from the abdominal (epigastrium) sensations, the explosions elicited a generalized sensation, usually described as a "jar" or "thud." It was concluded that calculated explosion pressures up to 70 pounds per square inch may be readily tolerated in shallow (5 feet) water.

Intestinal strips showed frank rupture at about 300 pounds per square inch (calculated). Petechial hemorrhagic lesions would probably occur at considerably lower pressures, since it is known that hemorrhage occurs at pressures incapable of producing frank perforation.

The fact that men clad in standard deep-sea diving dress feel definite pressure at 50 pounds per square inch, while the subjects in this experiment suffered no serious discomfort at 70 pounds per square inch, may be related to the fact that the diver is partially (head and chest) enclosed in a layer of air, and to other hydrodynamic factors resulting from his equipment.



6. Calculated lethal ranges for immersed personnel exposed to underwater explosions.

In a second experiment at Stump Neck, Maryland, under conditions identical with those prevailing at Fort Pierce (with the exception of temperature), a Naval officer approached detonated Mark V charges until a calculated pressure of 140 pounds per square inch was attained. At the same time identical tests of lethal pressure (beef-gut method) again confirmed the figure of between 250–300 pounds pressure per square inch as that sufficient to produce intestinal perforation. Still

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another test, made at Fort Pierce yielded a figure of approximately 260 pounds pressure per square inch. It may therefore be considered as established that an underwater blast pressure of over 250 pounds per square inch will result in intestinal perforation, and, for the reasons stated, that even lower pressures must be looked upon as "lethal" (fig. 6), or at least dangerous.

BLAST AND SHIPBOARD PERSONNEL

In the summer of 1942 the Navy conducted a series of experiments at the request of the Marine Corps to determine the effectiveness of shallow-water mines upon personnel occupying assault craft. Charges were arbitrarily limited to 150 pounds, because this was considered to be the maximum weight permissible for laying from small boats in shallow water. Test animals of such size as to simulate men were used. The animals were oriented and stabilized by means of carefully fitted harness and lines. All-steel assault craft were used in these tests, the charges (150-pound) being detonated directly below the keel in 12 feet of water. High-speed motion pictures (1,000 frames per second) recorded the explosions. All animals were recovered in less than 5 minutes following each blast.

Results.—Three separate trials were made. In no case was any animal injured, although the high-speed film record showed that some of them were projected an estimated 20 feet into the air. Even when landing craft were so badly holed as to sink almost instantly, this remained true. Moreover, the result was the same whether the animals stood upon wooden decking, sand bags, or a padding of 1-inch rubber sponge. All animals were retained at the National Naval Medical Center for observation and remained entirely normal over a period of months. Indeed, some of the females subsequently became pregnant, giving birth to healthy young. On the basis of these tests it was the opinion of Marine Corps observers that personnel subjected to the blast of shallow-water mines of this magnitude would not receive sufficiently serious injuries to prevent them from carrying out an assigned mission, and this method for the neutralization of assault craft in shallow water was abandoned.

The fallacy in the method, of course, lies in the fact that personnel within assault craft are not in direct contact with the water. Only those parts of the body actually immersed are subjected to the concussion wave, and therefore injury can only occur due to transmitted impact through the hull or to violent displacement, loose gear, striking the body against solid structures, and the like. Since a charge of 150 pounds should be lethal to personnel immersed in water to a distance of over 90 yards, and even 25 pounds of TNT would theoretically kill men throughout a 50-yard radius, it was suggested that a mine

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be so constructed as to first hole the assault craft, thus placing the occupants in contact with the sea. A second and smaller charge, detonated about 10 seconds after the first, would then become effective. However further experiments designed to demonstrate such a method of neutralizing enemy landing craft personnel were never carried out.

PROTECTION FROM BLAST

Methods thus far suggested for the protection of personnel from blast have been too impractical to warrant serious consideration by the military. As earlier noted, blast in air must be considered as a very remote danger indeed as compared with high velocity bomb and shell fragments or with flying stones, debris, falling walls, timbers, and the like, which accompany the detonation of high explosives. Thus, while there can be no doubt that men may be killed by the effect of blast *per se*, protection from fragments and missiles of all sorts is so much more urgently required (example, body armor) that the threat of injury from air blast becomes, by comparison, extremely remote.

Moreover the training of the soldier is, of itself, a training in the avoidance of injury from blast. That is to say, the tactics by which the soldier seeks to avoid injury from missiles are the most effective means of escaping the full impact of a blast. The intensity of blast pressure in air is greatly reduced in any depression, behind trees, or behind a vertical wall of any sort. Thus in utilizing even shallow inequalities of the terrain, tree trunks, walls, and ditches, the soldier is almost assured of protection from the blast of a detonating charge. It is well established that a covering of sponge-rubber, kapok or other resilient material over the chest and abdomen confers a very high degree of protection from blast (*37*) (*39*), but the rarity of such injuries does not warrant the use of such equipment. Even with the ever-present threat of wounds or death from shell fragments, it is only of very recent date that a body armor (with the exception of the helmet) has been considered practical, and in the past troops have tended to discard even such lifesaving equipment. Hence the issue of clothing to minimize the likelihood of serious injury by air blast might be said to border upon the ridiculous.

In the case of underwater blast quite the reverse is true. Casualties from this source continued throughout the war, and injury from this cause may be considered to be common at the site of sinkings during Naval engagements. The Greaves experiments, together with the fact that the majority of such cases involved only gastro-intestinal lesions, pointed, at an early date, to the fact that the standard Navy kapok life-jacket offers a high degree of protection from underwater blast, and the modification of this jacket to provide kapok padding over the abdomen was suggested by the Bureau of Medicine and Sur-

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gery. However, it was felt that such an addition would render the life-jacket too cumbersome for general use. The Royal Canadian Navy, on the other hand, designed and issued just such a jacket. Among American personnel, emphasis was put upon the avoidance of injury rather than protection from this recognized hazard, and personnel were instructed essentially as recommended in the report by Greaves et al. (*13*):

1. Wear your life jacket properly tied and adjusted. It is a "life preserver" that will protect you from underwater explosions as well as from drowning.
2. Swim away from an expected underwater explosion as rapidly as possible. You will be safe at a distance of 120 yards from a 300-pound depth charge, or 150 yards from a 600-pound depth charge, even without your life jacket, and at a considerably less distance if you are wearing it.
3. Make use of any floating object that will support you to draw yourself out of the water, particularly your chest.
4. Keep your head out of the water and when resting float on your back, as high in the water as possible. Remember, only those parts of your body that are submerged will be affected by an underwater explosion.
5. Do not lie on a partly submerged raft when underwater explosions are expected. Stand or sit, so that the shock will not be transmitted to your chest or abdomen.

Thus the matter of the prevention of underwater blast injury rested.

The Bureau of Medicine and Surgery, in an effort to produce a Navy "battle dress" to protect personnel from drowning, flash-burn, blast, and missiles, worked on the principle that the one certain means of preventing injury by underwater blast consists of raising the body out of contact with the water. To this end, individual, inflatable floats were fabricated which were enclosed within a small pack worn on the back. These floats, which weighed but 4 pounds complete with gas cylinder, were capable of providing complete flotation and were really very light-weight, one-man rafts. However, due to the general unreliability of gas-inflated flotation gear, and the likelihood of puncture of the necessarily thin material of which these floats were made, none of the equipment saw service. It is, however, interesting in retrospect to conjecture as to the possible benefit to have been gained by equipping all hands with these small, pack-contained floats in addition to regularly issued gear. Since a single float would provide flotation for from 6 to 8 men, a high percentage of failures would leave a great number of such floating mats spread over an immense area, were but a few hundred thrown into the sea at the site of disaster.

Another "anti-blast unit" of heavier construction was developed by a commercial concern and tested by the Navy. This equipment also stowed within a small pack worn like a haversack, inflation being accomplished by firm traction on straps beneath the arms. It is probable that a general trend away from relatively unreliable gas flotation in favor of kapok, fiberglass, or similar material mitigated

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against the service trial of this equipment. The above solutions of the problem of protection against blast are cited as examples of the frequent impracticality of devices offered to the services which are fundamentally sound in principle but remain impractical due to the conditions of naval warfare.

In an attempt to afford maximal protection against underwater concussion to deep-sea divers, an "anti-blast" vest was developed in England. The design was based upon the sound principle of covering the thorax and abdomen with a layer of kapok or cotton padding which had been shown by all investigators in the field to be to some degree effective. The design of the vest was excellent, and it was secured by simple ties of cotton tape, affording complete coverage of the thorax, abdomen and perineum. It was intended to be worn over the diving underwear, next to the rubberized dress.

Two of these vests tested by the Navy indicated that a certain amount of protection was indeed afforded, but the adoption of this item as standard equipment was not considered justified due to the increased labor entailed in dressing the diver, and the added bulkiness. In the Navy tests this equipment was found to increase the "lethal" pressure by 225 pounds per square inch. According to calculation this would reduce the distance at which a diver might survive the detonation of a 300-pound (Mark VI) depth charge from 97 to 55 yards. Thus. this type of equipment would appear worthy of further development. provided the protection of divers from blast is desired. The British gear was loosely-packed and apparently cheaply made, but the results of the tests referred to make it appear quite possible that a somewhat heavier, well-packed and carefully designed garment might offer a surprising degree of protection. Provided such a vest were fully flexible, a reasonable increase in bulk and weight could hardly offer grounds for objection when the size and weight of our deep-sea gear alone are considered.

Protection from blast may thus be secured by three principal methods:

1. *Avoidance of the full force of the blast* by utilizing depressions in the terrain, bunkers, and shelters; the use of floating debris in raising the chest and abdomen as far out of the sea as possible; utilizing a knowledge of known lethal distances, etc.

2. *Wearing protective gear* of a soft, yielding material; use of the kapok life jacket, preferably extended to cover the abdomen; use of Navy "battle dress" or similar equipment.

3. *Entirely escaping the effects of blast* by the use of flotation to raise the body entirely out of contact with the sea; rapid retirement beyond the lethal range of expected blasts.

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SYMPTOMATOLOGY OF BLAST

The victim of blast injury invariably presents a history of being in the near vicinity of an explosion. In the case of underwater concussion, all men taken from the water may be suspected of having sustained this type of trauma in instances where submarine explosions have taken place.

Pulmonary damage or "blast lung" is indicated by blood-tinged sputum or even the frank expectoration of blood. Respiratory embarrassment, pain in the chest, râles, and pulmonary dullness complete the picture. Location, extent and severity of the lesions may be determined by x-ray examination.

In cases in which the gastro-intestinal tract has suffered damage, clear-cut diagnosis may be more difficult. A common indication is the occurrence of loose bowel movements, sometimes accompanied by abdominal cramps and pain while still in the water and shortly following the explosion.

Other patients suffer no distress until drawn from the water, when severe pain may supervene. In frank perforation of the bowel the symptoms exhibited are, of course, those of a rapidly developing peritonitis with elevated temperature, high leukocyte count, and tender, rigid, board-like abdomen. Shock is of frequent occurrence in blast injury of either pulmonary or gastro-intestinal type. Many patients present symptoms of both types of lesion, but in general the lungs appear most frequently affected by air blast, while the reverse is true in Naval experience with underwater concussion injury.

In those cases in which no perforation of the bowel has taken place at the time of the explosion, hemorrhagic lesions may be present. Such patients may remain symptom-free, or perforation of the gut may supervene at a later date. This late performation is brought about by the ischemia of the bowel wall at the site of injury, due to blood clot formation with eventual necrosis and sloughing of a small area of the intestinal wall.

TREATMENT

The treatment of pulmonary blast injury is much like that of pneumonia. Shock therapy is often necessary, but here the raising of the blood pressure by intravenous infusions of whole blood, saline, or plasma must be carried out with caution because of the danger of increasing pulmonary hemorrhage. For the same reason, artificial respiration by the Schaefer method or any other drastic manipulaton of the patient is contraindicated except when necessary due to the exigencies of field conditions. Immediate and comfortable bed rest is

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essential. Sedation is said to be helpful unless contraindicated by shock, and oxygen administration is often of value. In cases in which hemorrhage has invaded the respiratory passages, aspiration may be of benefit. Tracheal insufflation has been used.

Under ideal conditions an exploration of the abdominal contents is in order when surgical judgment indicates that perforation of the gut has taken place. This is not always possible, and the conservative treatment of suspected underwater blast injury has, happily, resulted in a high percentage of recoveries. This has been attributed to the fact that in such lesions the peritoneum often remains intact, resulting in a self-limitation of infection. In general, however, one must conclude that the treatment of choice for such patients is prompt surgery when indicated by clinical judgment.

FUTURE RESEARCH

Although our basic knowledge of the effects of blast is fairly complete, at least in its more practical aspects, continued progress in the development of ever-improved explosives and other methods for the ultra-rapid release of energy make necessary the prosecution of a program of research on the effects of and protection against this military weapon.

Such studies will probably be medical in nature only to a very limited degree and may be expected to center largely around the vulnerability of hulls, bombproofs, buildings, etc., resulting in the design of ships, structures, and military and civilian installations of all types which will be, to a high degree, resistant to demolition by blast.

The development and construction of blast gages of newer types will probably be continued, with piezo-electric equipment immediately supplanting the cruder methods of pressure measurement now in general use. This is of paramount importance in all studies on the intensity of blast, as accurate pressure measurements, together with time recordings of peak pressures, are essential to an understanding of what has taken place. Cruder methods of pressure estimation may be said to have largely outlived their usefulness.

From the military standpoint, research will probably be continued in many fields. The clearance of underwater obstacles will progress beyond the present stage of development, efficient as those heroic methods were in the Pacific war just closed. Methods for the demolition of caves and the neutralization of personnel by blast will almost certainly progress from crude but effective blocks of explosive held together by tape and detonated by means of matches and fuses.

The determination of dangerous and lethal blast pressures for personnel needs to be re-investigated and more accurately determined

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through unhurried research, made possible during peace. Phases of such research as yet untouched would bear careful study. Thus, the effects of blast within closed spaces should be studied and thoroughly investigated with a view to protection from this hazard. Such research might also be a valuable aid in increasing the casualty-producing properties of anti-personnel bombs and shells, as well as in the improvement of equipment for the neutralization of pillboxes, cave installations, dugouts, and similar fortifications. Much, therefore, remains to be done requiring the united efforts of our military and Naval facilities, the chemist, the physicist, the medical research specialist, and the physician.

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PINTA-LIKE LESIONS AMONG NATIVES OF GUAM

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During a recent survey of 2,006 natives on Guam, 39 were found to have hyperpigmentation and depigmentation of the skin, the lesions being limited to the extremities and the face. In a high percentage of these people serologic examination yielded positive findings. Careful and repeated questioning failed to elicit any history of previous lesions suggestive of yaws or syphilis, nor did inspection reveal any scars or other deformities commonly seen in these diseases.

This disease is known to the Chamorros of Guam as *peladang* (spotted). It is more prevalent among the people who live in the southern half of the island than among those who live in the northern part. The southern half of Guam is mountainous country rising from central lowlands. This area is thickly forested and has numerous streams and marshes. Rainfall is abundant and the relative humidity is high (from 80 to 90 percent). The northern half of the island is a limestone plateau. Because of this permeability of the limestone, no streams or marshes are found in this area. Thus the northern half of the island is comparatively dry. Certain of the treponematoses, such as yaws and pinta, are, according to Stitt, favored by a warm moist climate and seldom persist in dry areas.

Of the 39 patients under observation, the youngest was 21 and the oldest 83 years of age. The ratio of females to males in this group was 2.2 to 1, while the ratio of females to males in the entire native group examined was 1.3 to 1. Distribution according to age and sex is shown in table 1.

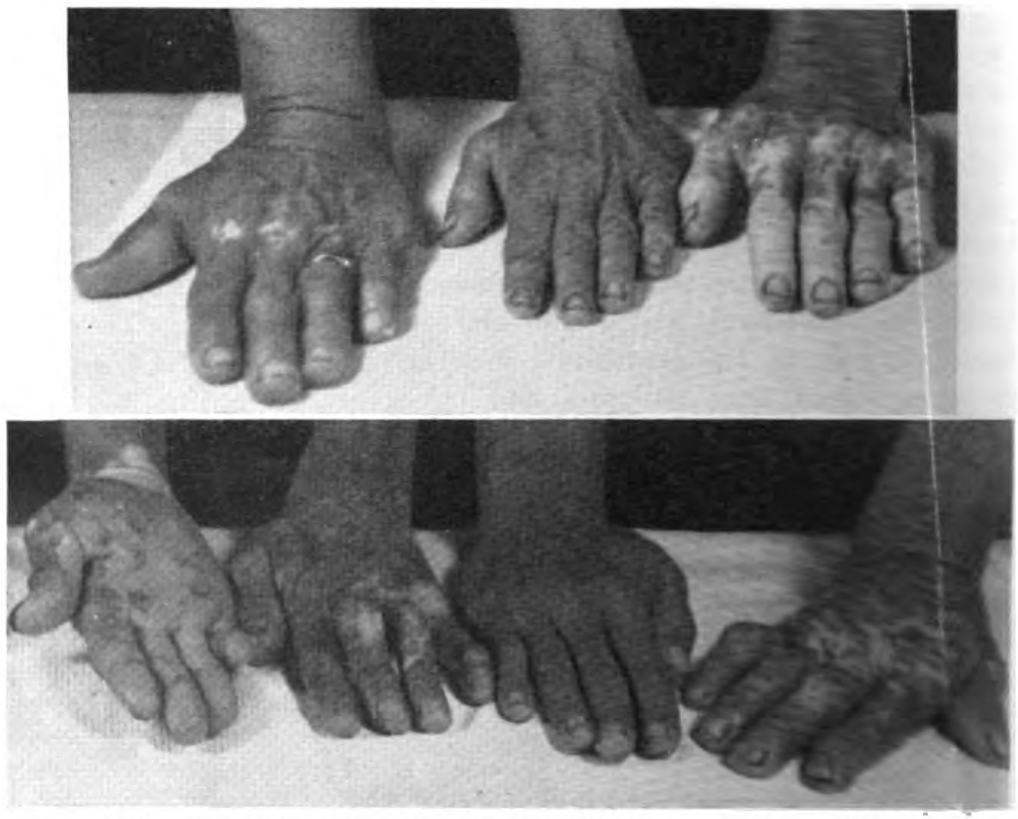
TABLE 1.—*Distribution of 39 cases according to age and sex*

Age	21 to 30		31 to 40		41 to 50		51 to 60		61 to 70		71 to 80		Total	
Sex	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Number of cases	1	5	1	4	3	6	7	4	0	4	0	4	12	27

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The duration of symptoms among the patients ranged from 3 to 20 years. In general the history of the lesions was as follows: Usually they first appeared as small hyperpigmented areas on the dorsum of the hands or feet or both. The lesions frequently itched for a short time and were occasionally attributed to insect bites. Itching was described as mild and of not more than 1-week duration. The areas of hyperpigmentation spread slowly, and other darkened areas appeared nearby and on the other extremities. With progression of the lesion the center became pale and finally lost all pigment. These depigmented spots enlarged and coalesced to produce increasingly larger grayish-to-white areas of irregular shape. The discoloration of the skin was usually from below upward, and depigmentation was always preceded by hyperpigmentation. There was no pain, and none of the patients had systemic complaints attributed to the disease.

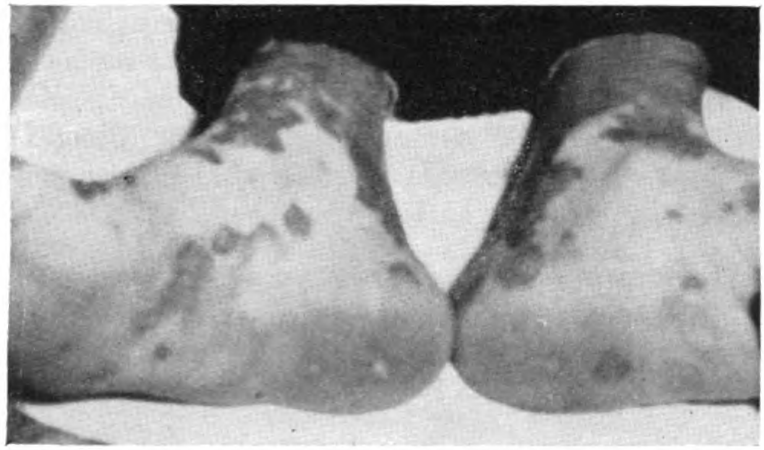
The lesions observed were limited to the extremities and the face and consisted of areas of hyperpigmentation interspersed with depigmentation, of irregular shape and size (fig. 1). There was no inter-



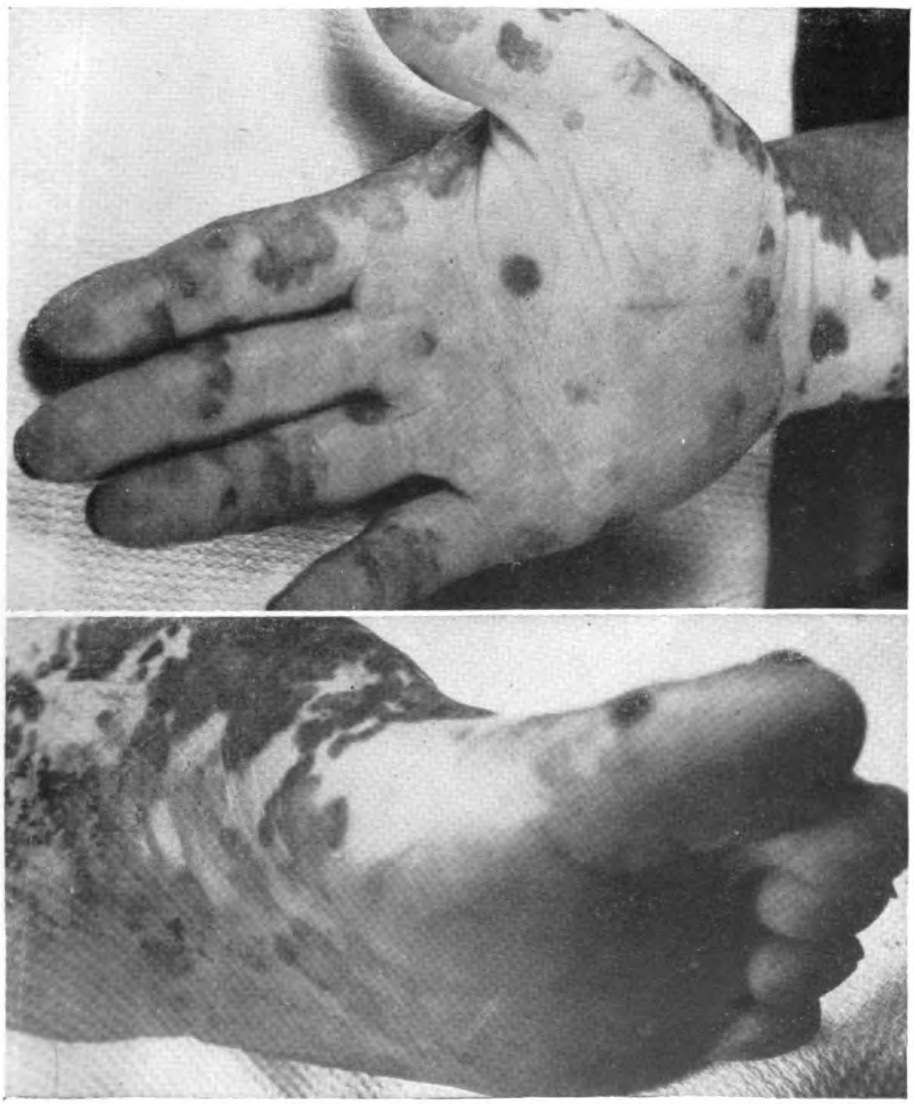
1. Lesions of irregular size and shape limited to the extremities.

ruption of the integument. The depigmented areas varied in color from gray to white; in two patients the lesions had a pinkish hue. Often the alteration of pigment was symmetric in distribution (fig. 2).

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2. Symmetric distribution of hyperpigmentation and depigmentation.



3. Involvement of the palms and soles.

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Eleven (28.2 percent) of the patients in this series had involvement of the palmar surface of the hands and the plantar surface of the feet (fig. 3). In no instance were fissures of the palms or soles seen as a result of this disease. The depigmentation would often extend from the palms to involve the ventral surface of the wrist, in a roughly triangular shape (fig. 4).



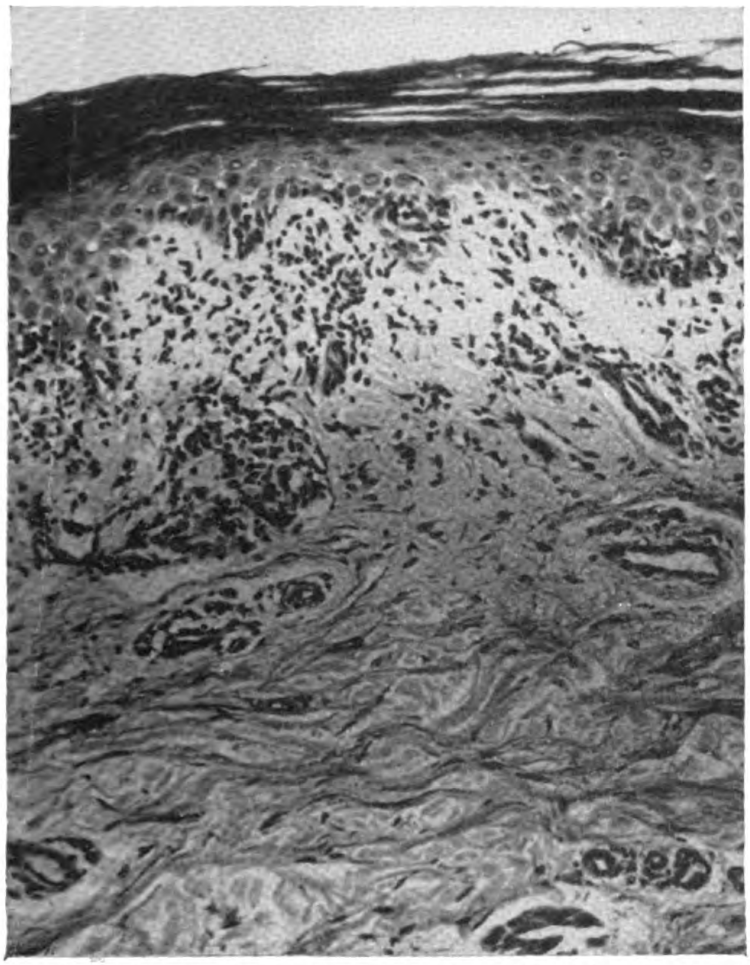
4. A triangular-shaped lesion on the ventral surface of the wrist was a common finding.

Biopsy specimens taken from the depigmented areas are shown in figure 5. There is atrophy of the epidermis with flattening of the rete pegs. The stratum corneum is thickened despite this atrophy. Pigment is scanty in the basal layer, and concentrations of chromatophores are seen in the upper layers of the dermis. The dermis is edematous and infiltrated with numerous lymphoid cells.

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Sections taken from areas of hyperpigmentation are shown in figure 6. There is keratinization of the epithelium. The rete pegs are elongated and cord-like in appearance. Pigment is abundant in the basal layer, and collections of chromatophores are seen in the dermis. The vessels are numerous. Perivascular areas contain moderate numbers of lymphoid cells. The upper portion of the dermis is occupied by a cellular infiltrate of lymphoid cells.

Blood Kahn tests were done on 29 patients. Twenty-two (76 percent) of them gave positive reactions, and seven (24 percent) were negative. As a control, blood Kahn tests were done on 1,000 Chamorros selected at random from the native population. In only 56 (5.6 percent) of the control group were the test reactions positive. The difference in the observed rates between the control and selected groups was statistically significant, as shown by a calculation of the standard error of the difference between the two groups.



5. Photomicrograph of biopsy section taken from area of depigmentation. × 200.

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6. Photomicrograph of biopsy section taken from area of hyperpigmentation. × 200.

Nine darkfield examinations were done on six patients. Abrasions were made at the outer edge of dyschromic plaques and serum was collected. No treponemata were demonstrated. Blood Kahn reactions in these six cases were positive. Accurate information was not obtainable as to whether these patients had received any arsenical or bismuth therapy during previous years. For many years the natives of Guam have been encouraged by the Navy medical officers on the island to present themselves for serologic study, and on several occasions intensive campaigns have been carried out in an attempt to eradicate yaws from the island. As a result of these procedures, a great majority of the natives have at some time during the past been subjected to serologic tests, and, if the reactions were positive, the natives were treated for various lengths of time, many of them reporting for only one injection and failing to return for further treatment. A native is frequently unable to give accurate information as to whether blood was taken from, or medicine injected into his vein

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during a visit to the doctor. It was the authors' opinion, after questioning many of these people, that most of them had been given at least one or more injections of some arsenical during the period in which their serologic reactions were positive.

One patient (female) gave a history of having been admitted to the hospital in 1939 or 1940 for an illness unrelated to her skin disease. During her stay in the hospital, it was discovered that she had a "positive blood test." She was then given injections into her buttocks and into her arm at 4-day intervals. She claims to have had six such treatments. (We assume that this therapy consisted of bismuth intramuscularly and arsenicals intravenously.) Soon after this therapy was begun she noted a regression of the lesions on her extremities. Improvement continued even after treatment had been discontinued and she had left the hospital. All hyperpigmentation disappeared, but the areas of depigmentation remained a gray, dusky color. When she was examined in 1944 with the group reported in this paper, there was still no return of hyperpigmentation. The blood Kahn reaction was positive.

COMMENT

Manifestations of hyperpigmentation and depigmentation of the skin have been reported in all of the known treponematoses (*1*) (*2*) (*3*) (*4*) (*5*). Moss and Bigelow (*6*), in a report of 1,046 cases of yaws in the Dominican Republic, mentioned "studded lesions of yaws," and illustrated cases showing vitiligoid lesions. Mayer described lesions of the palms with loss of pigment in yaws cases (*7*). Gutierrez (1923) reported palmar lesions with vitiliginous changes among inhabitants of the Philippine Islands. Wilson has observed similar lesions among patients with yaws in Panama. Hudson (*8*) saw vitiligoid lesions in Syria, among the Bedouins suffering with bejel. LeLoir and Tenneson are quoted by Lane (*9*) who presented a review of the literature in 1921 and called attention to the frequency of the vitiligo among tabetics.

Recently Lurie (*4*) recorded good results from intramuscular injections of bismuth in 124 vitiligo patients (112 white, 11 Negro, and 1 Chinese). The author attributed the vitiliginous lesions to syphilis, and submitted evidence to show that many of the patients were congenital syphilitics. The racial mixtures reported, particularly in the cases of Mexicans, bear an important relationship to treponematoses reported by various names, including pinta.

Menk (*10*) in Columbia in 1926, and Gonzales Herrejon (*11*) in Mexico in 1927 submitted serologic evidence that pinta (carate, mal del pinto, guasarole) was among the treponematoses. During the next few years numerous cases were studied, and evidence mounted showing

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that a high percentage of patients had positive serologic reactions (*12*) (*13*) (*14*) (*15*).

In August 1938 a treponema indistinguishable from T. pallidum and T. pertenue was demonstrated in serum from lesions on the ankle and wrist of a pinta patient in Cuba by Drs. Grau Triana and A. Armenteros and two days later the same spirochete was demonstrated in biopsy specimen by Saenz (*16*). The findings were quickly confirmed by others in Cuba (*17*), Mexico (*18*), Venezuela (*14*) and Ecuador (*19*) (*20*). Leon y Blanco (*21*) in experimental studies, has shown that the disease is evolved in three distinct stages (similar to the other treponematoses) and that the stage of dyschromia of the skin with resulting leukoderma is merely a late and terminal stage of a process that has been evolving for a long period of time. Although the disease occurs in countries in which yaws and syphilis are endemic, it differs clinically from the commonly accepted version of the picture presented by these diseases in certain respects; namely, predilection for skin involvement, lack of ulceration and fissures, slow progress of the lesion, and a peculiar pathologic picture. It has therefore been accepted by many as a separate and distinct entity.

Because of the prevalence of this syndrome among the peoples of Mexico, Central and South America, and the Caribbean Islands, much interest in it has been shown by workers in these areas. Because of their work, and possibly because of lack of interest in the disease in other parts of the world, pinta has been referred to as a disease "almost entirely American" (*22*) (*17*) (*23*). A search of the literature, however, will reveal that the disease has been reported from scattered parts of the world—Algiers (*22*), Philippine Islands (*24*), Marshall Islands (*25*), Malaya (*26*), Egypt (*27*), Gold Coast (*28*), India (*29*), Ceylon (*30*), the United States (*31*), and others.

The patients herein reported from Guam exhibited lesions indistinguishable from those seen in pinta patients of the western world. There was no evidence, either historical or physical, to indicate that these people had had previous lesions which are commonly believed to accompany yaws or syphilis; nor was there evidence at the time of examination (other than skin dyschromias) to indicate the presence of either of these diseases. It is therefore believed that these cases occupy the same position among the treponematoses as is occupied by those called pinta in the Western Hemisphere.

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TREATMENT OF ACUTE STAPHYLOCOCCIC OSTEOMYELITIS WITH PENICILLIN AND WITHOUT SURGICAL OPERATION

Penicillin therapy without any early surgical procedure was employed in eight cases of acute hematogeneous osteomyelitis, in six of which a demonstrable bacteremia was present. There were no deaths. Except in one case, in which we believe treatment was inadequate, the results were uniformly good. Pain, fever, and swelling were diminished within a day or two, and steady improvement usually followed.

Roentgenographically visible changes with rarefaction and periostitis occurred in most of the cases regardless of penicillin therapy but as a rule these lesions healed in a few months. The patients for the most part were clinically well within 1 to 2 months. Intensive penicillin treatment over several weeks is advocated for acute osteomyelitis.

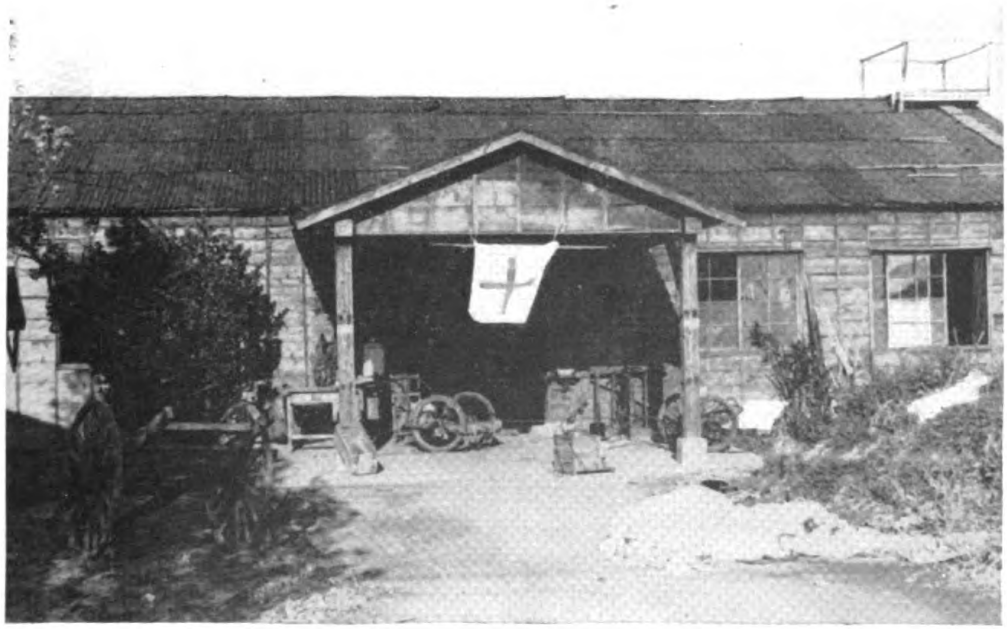
The reporting of these cases is not to be understood as a final recommendation that in every instance of acute osteomyelitis treatment without operation should be employed. Even if penicillin is given, the physician must use his judgment as to the advisability of surgical intervention as well.—BLOOMFIELD, A. L.; KIRBY, W. M. M., and ARMSTRONG, C. D.: Treatment of acute staphylococcic osteomyelitis with penicillin and without surgical operation. Stanford M. Bull. 3: 161–175, November 1945.

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IMPRESSIONS OF A POW MEDICAL OFFICER IN JAPANESE CONCENTRATION CAMPS

MACK L. GOTTLIEB
Commander (MC) U. S. N. R.

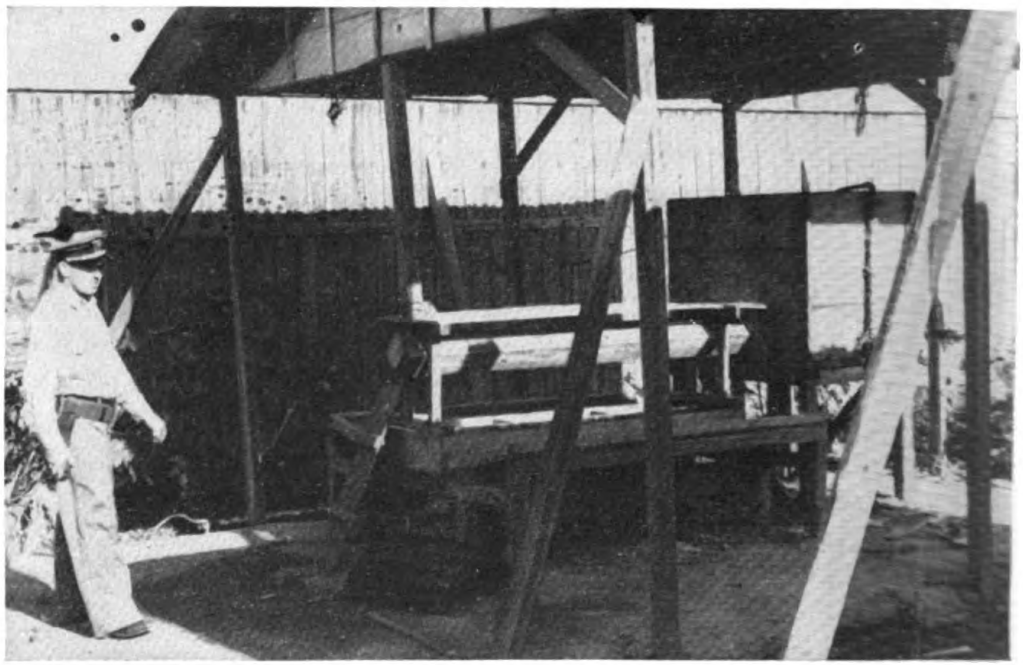
Medical experience in Japanese prisoner-of-war camps was unprecedented in history. Never before had so large a group of white men, accustomed to a western diet and mode of living, been subjected to a diet so radically different from their own, not only in quality, but in quantity. Our patients in the Shinagawa prisoner-of-war hospital in Tokyo consisted of American, British, Canadian, Dutch, Australian, Chinese, Indian, Portuguese, New Zealand, and Italian nationalities. The dietary change, along with rigorous Japanese discipline, mental torture, cruelty, the performance of rather severe manual labor in all types of weather, and the lack of adequate clothing, extremely poor sanitation facilities, inadequate medical supplies, and the fact that many of us were prisoners of war for almost 4 years, created a pathophysiologic "human guinea pig" which would be impossible to simulate by experimental methods.



1. Main administration building. The Geneva Cross flag was hoisted after the atomic bomb struck Hiroshima.

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Approximately 1,100 prisoners were treated between July 1943 and March 1945, with a mortality of only 66 patients. From March until 29 August 1945, the day of liberation, all medical personnel in the Shinagawa prisoner-of-war hospital, were laboring with pick and shovel from 0730 to 1900, and during this period the Japanese commandant engaged in vicious medical experimention with prisoner-of-war patients, literally taking the hospital from us.



2. Washstand in courtyard of the camp being examined by armed American Naval officer.

Although we were unable to investigate the mineral and chemical nature of the blood, or do basal metabolic studies, we were able to examine the peripheral blood, do sedimentation rates, urinalyses, gastric analyses, blood smears for malaria, x-ray examinations of the lungs (the American Red Cross purchased a small field x-ray unit), induce pneumothoraces (we constructed a pneumothorax apparatus out of two Vacoliter bottles, some plasma rubber tubing, and a homemade "three-way switch" made out of the tops of foot powder tins, and a suitable needle), and do visual field studies in nutritional amblyopia (we built a perimeter and improvised a visual field pattern on a "blackout" curtain). We also performed retinoscopies, made stool investigations for amebiasis, bacillary dysentery, and parasitic infections, improvised water suction apparatus for abdominal and chest paracentesis, did biliary drainage, van den Bergh estimations, and performed major and minor surgical procedures. We constructed a steam sterilizer for our surgical packs, which of course was inadequate

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from a bacteriologic point of view, because of the inability of obtaining sufficient steam under sufficient pressure.

In addition we investigated sputa for acid-fast studies and Gaffky counts, did spinal taps and made studies of the cerebrospinal fluid, and treated patients dentally with a homemade dental drill, constructed from a speedometer cable of a wrecked automobile, and dental burs made out of steel scraps. Our silver fillings came from 50-cent Dutch guilder pieces, which we filed down into fine powder-like particles.

We fabricated splints, crutches, Balkan frames, and other orthopedic devices. The ingenuity of the prisoners so amazed the Japs that a remark was made that, "If the Americans were left alone, they could construct a small railroad." One of the men built an incubator out of an old Red Cross box and scraps of tin and wire, and it kept an even temperature. The mathematics of the coefficient of expansion of the metals and other factors were calculated by an Annapolis graduate who was serving in the Civil Engineer Corps. A Gigli saw for amputations and rib resections was constructed from mandolin strings, and was quite effective.



3. Captain Frederick L. McDaniel (MC), U. S. N. (right) and Commander James L. Bradley (DC), U. S. N., inspecting a corner of the clinical laboratory.

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We saw two phases of malnutrition—the acute phase and the chronic one. In the acute phase, the picture was startling, one of multiple vitamin deficiency, aggravated by a malicious diarrhea of amebic, pellagrous, or bacillary nature. The diet, which consisted mainly of unpolished rice, some soybeans and very little meat, fish, or vegetables, averaged about 1,500–2,000 calories a day, but the presence of this vicious diarrhea vitiated the little good which might have been obtained from this meager diet.

The severe malnutrition was further complicated by chronic malaria and multiple skin infections. Another very important consideration was that the suddenness of the change from an adequate Western diet did not permit the body to adjust itself. While I was not in the Philippines and did not personally observe this acute phase of malnutrition, I have subsequently treated hundreds of these patients who narrated their experiences, and have talked with medical officers who were stationed there after the surrender. The vitamin A deficiencies manifested themselves by numerous cases of xerophthalmia with corneal ulceration, and subsequent scarring and chemosis. This condition responded fairly well to administration of cod-liver oil.

The nutritional amblyopia due to vitamin B_1 deficiency was more extensive and did not respond as well to replacement therapy with vitamin B_1. Many of the patients developed retinal degeneration and contraction of the visual fields and central scotomata. Pupillary reflexes were poor, and many of the fundus pictures resembled those observed in hypertension, with constriction of the arterioles, signs of arteriovenous compression, and hyperemia of the disk, with some accentuation of temporal pallor. Very few of these patients displayed hypertension of the systemic circulation. It is interesting to note that one of the British medical officers, who served in Hong Kong before and after the surrender, told me that most of their patients who developed nutritional amblyopia with retinal degeneration were not from the regular British army, but men who in civilian life had had a richer and more varied diet. In other words, the dietary change produced more avitaminotic damage in a person whose "food threshold," so to speak, was at a higher level and whose capacity to withstand sudden change in dietary regime was not as great as that of the regular soldier. We had an opportunity to study these cases of nutritional amblyopia over a period of years, and very few of them improved once retinal degeneration had taken place. It appeared to us that the mere replacement of vitamin B_1 was not the therapeutic measure that it was thought to be in a clinical condition of this nature.

The polyneuritic and edematous type of beriberi was unquestionably the most frequent pattern of vitamin deficiency observed. Very few

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prisoners of war were unaffected. Beriberi manifested itself by symptoms in the lower extremities but rarely in the upper extremities. There was pain along the tibia, aching and numbness in the small joints of the feet, great weakness of the legs, and if the condition persisted, muscular wasting and atrophy, especially of the gastrocnemic muscles and the extensors of the thigh. Abadie's sign, or loss of deep sensibility of the Achilles tendon, was seldom present.

Objectively, the most important sign was the inability to perform the "squatting test," which consisted of placing the hands on the head, balancing on the balls of the feet, doing a deep knee bend, and then raising the body to the erect position. This test was positive in a very large number of patients. Various zones of hyper- and hypoesthesia were found in the thighs, legs, and feet. The superficial reflexes were usually normal, but the deep reflexes were lost in most instances and exaggerated in a few. Foot drop was observed in a few persons and even wrist drop.

This is the clinical picture of the polyneuritic type of beriberi. The neuropathy of this syndrome is well-known, and the pathosis may limit itself to the peripheral nerves, the dorsal root ganglia, the anterior horn cells, nuclei of the medulla, pons, the cranial nerves, the lymphatic system, and even to the vagus and the phrenic nerves. Many prisoners of war manifested axilary, inguinal, submaxillary, and posterior cervical adenopathy without any demonstrable local lesion.

If the pathosis was in the spinal cord, then the so-called paraplegic type of beriberi developed. Many such cases were seen at Shinagawa, especially among prisoners of war who had extremely difficult and tiring work to perform, such as pushing coal trucks. It appeared that severe muscular strain increased the tendency for the development of the paraplegic type. Complete flaccid paralysis and loss of all deep reflexes were noted. Zones of marked hypoesthesia and some scattered areas of hyperesthesia in the lower extremities were observed. If these patients could walk, the so-called "wide base gait" was noticed.

The edematous or wet type of beriberi was often seen. It was difficult to understand why so many men, living on the same dietary regimen, would develop different clinical manifestations of the disease. In the edematous form, almost all of the patients gave a history of severe diarrhea, from 8 to 10 loose watery stools daily. After the diarrhea was controlled by administration of sulfaguanidine or carbarsone, the edema would appear, being localized to the feet, face, legs, and frequently the scrotal sac, and would persist until the recurrence of diarrhea and then would disappear. As soon as the diarrhea was controlled the edema would return. It was most unusual to find

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an edematous type of beriberi in a patient who did not have a history of antecedent diarrhea.

The edema would diminish with plasma therapy and massive doses of thiamine hydrochloride intravenously. The usual dose was 200 milligrams with 50 milligrams of vitamin C every 4 hours until the edema subsided. Paracentesis of the chest and abdomen was performed to relieve fluid accumulations. Digitalis in full digitalizing doses was administered when heart failure was imminent. Limitation of fluids and application of local heat over the kidneys, in an attempt to stimulate urinary output, was also resorted to. Vitamin B_1 was also administered by mouth in 3 divided doses of about 90 milligrams a day, and nicotinic acid, 150 milligrams a day in 3 divided doses. All patients in the hospital received 1 or 2 multivitamin tablets daily as well. During this therapy the edema would subside gradually, possibly taking 1 week or more. However, if diarrhea occurred, then the edema would disappear very quickly. About 40 percent of all prisoner-of-war patients had chronic amebiasis, and this would produce recurrent bouts of diarrhea. Red Cross drugs and supplies were received about Christmas of 1943; prior to that time we had to depend on the Japanese drugs which were of poor quality and insufficient in quantity. The Japanese vitamin B_1 was in the strength of 2 milligrams per cubic centimeter solution, whereas the American drug had 100 milligrams.

We were most fortunate at the Shinagawa hospital, for we received large quantities of Red Cross hospital supplies, and from December 1943 until March 1945 (aside from the supplies which the Japanese looted and stored in Tokyo and Yokohama), we managed through under-cover methods to distribute them to outpatients. The Japanese doctor in charge of the hospital had established a so-called "ceiling" of the quantity of drugs to be dispensed. We also resorted to the smuggling of drugs to other camps by secreting them on the persons of patients who would be discharged from our hospital to their respective camps. We had at our disposal all of the sulfa drugs, antimalarial and antiameba preparations, cardiac and respiratory stimulants, intravenous and spinal anesthetics, in fact an almost complete pharmocologic armamentarium. Unfortunately we had no penicillin, although we had heard of the drug.

I was firmly convinced that vitamin B_1 therapy of itself was inadequate in producing clinical betterment in many malnourished patients with the syndrome of beriberi, that adequate and proper food, the control of diarrhea, and the correction of other vitamin deficiencies were essential parts of the treatment. The requirement of vitamin B_1 for the average person is about 2 to 2.5 milligrams per day. Our diet of about 1,500 to 2,000 calories a day consisted mainly

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of rice, barley, and soybeans. In 100 grams of unpolished rice there is only from 0.2 to 0.4 milligram of vitamin B_1; in 100 grams of barley, from 0.3 milligram to 0.6 milligram of vitamin B_1, and in 100 grams of soybeans, from 0.47 milligram to 0.64 milligram of vitamin B_1. The loss of vitamin B_1 from the body was an additional cause predisposing to the beriberi state. Most prisoners of war had a marked polyuria, due to: (1) Our diet containing practically no salt; (2) we were drinking about 30 ounces of tea a day and had another 24 ounces of soup daily; and (3) the rice, when cooked, absorbing large quantities of water. This marked polyuria, and the diarrhea, caused an excretion of vitamin B_1, previously described.

Utilization of vitamin B_1 was interfered with, due to liver changes seen in most of the patients who came to necropsy. The liver showed fatty changes grossly. Another significant fact was the high incidence of infectious hepatitis among prisoners of war. The liver, the chief "food commissary" of the body, apparently bore the brunt of the malnutrition experienced by the men. Five cases of cirrhosis of the liver were seen in young men with no antecedent alcoholic or luetic history, the cause of the cirrhosis being apparently nutritional. The high carbohydrate diet aggravated the requirements for vitamin B_1 and there was not sufficient fat or protein in the diet to counterbalance this. The prisoners who worked in the various factories and railroad yards had an opportunity to augment their diet by swapping with the Jap workers, or even helping themselves, when they could, to food stores. However, the Japs informed us that sick men, according to Japanese army regulations, would be given less food than the workers, and as a result our patients fared worse than the men in the outside camps.

We received very little Red Cross food, approximately one package per man, per year, although in 1944 at Christmastime, we received three packages. On one occasion, during the winter of 1943, there were about 60 very ill pneumonia patients, and there were about 24,000 Red Cross food packages stored in the camp. I asked the Japanese doctor for four parcels of food for the 60 very sick men, and this request was denied. About 8 bottles of milk would be delivered to our hospital daily, and the Japanese officers would take 4 or 5 bottles daily. The theft of Red Cross food, clothing and medical supplies, was conducted on a very wide scale.

The cardiovascular findings in the edematous cases of beriberi were a high pulse pressure, no bradycardia, but rather a tendency toward a tachycardia, intensified P_2, and a "pistol shot" sound heard over the femoral artery. I did not particularly observe any adventitious cardiac sounds, or any demonstrable cardiac enlargement. Sudden

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cardiac death, or what the Japanese term *shoshin*, was seldom encountered. Even at necropsy the heart was rarely found to be enlarged. We observed, besides the liver changes, an atrophy of the mucosa of the gastro-intestinal tract, especially noticeable in the small intestine and stomach, and clinically we saw a rather high incidence of perforation of peptic ulcer. We also observed a rather high incidence of appendicitis, although the amebiasis contributed to this condition, for the vegetative form of *Endamoeba histolytica* was demonstrated in the appendiceal stump.

In the acute phases of malnutrition in the Philippines, medical officers observed gynecomastia, and in some instances lactating breasts among the male prisoners, abscesses in the testicles (in some cases orchidectomy was performed), endocrine disturbances simulating hypothyroidism, and even hypopituitary syndromes. The marked disturbances in water metabolism, so strikingly observed in the early months of captivity, may have been due to pituitary lobe imbalance. It has been commented that the beriberi heart and the myxedema heart have a clinical resemblance, in that the waterlogging of the heart muscle causes a disturbance in contractility of the heart, and not so much of an effect on conductivity of the heart muscle. Thyroid was administered orally in several edematous beriberi cases with no apparent effect.

The clinical synthesis of vitamin B_1 is intimately related to pyruvic acid, which in turn is affected by the carbohydrate metabolism of the liver, which is also chemically related to the thyroid and adrenal glands. The adrenal gland is the major storehouse in the body for vitamin C. The liver is responsible for the synthesis of vitamin A. It is very likely and clinically logical to assume that, in severe malnutrition, we are confronted with a multiple vitamin deficiency state, and that one type of vitamin deficiency will predominate, depending on the site of maximum pathophysiologic disturbance.

Skin infections, especially furunculosis, were very common throughout the period of confinement. Epidemics of diphtheria occurred in many camps, and it is possible that some of the ulcers of the legs harbored diphtheroid bacilli, which may have caused the epidemics of adult diphtheria. In the acute phase of malnutrition, severe numerous cases of scurvy and pellagra were encountered. Hemorrhages into the pericardial sac, intraperitoneal hemorrhages, hemorrhages into knee joints and muscles, and even subdural hemorrhages were seen. Very little scurvy was noted in the chronic phase of malnutrition. This bleeding tendency in scurvy may be related to an adrenal gland insufficiency. Another factor is that large quantities of vitamin C are thought to be eliminated from the body in profuse sweating, which might explain the occurrence of severe scurvy in the southern

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islands and the absence of scurvy in Japan. The salt-poor diet may also have influenced the activity of the adrenal glands.

Many of the prisoners of war from Java and Sumatra informed me of a so-called "specific" for beriberi, used very widely in the Dutch East Indies. It is called *katzang idjyo* or green pea. These peas are served in a porridge with sugar, taken daily by the natives as a curative and prophylactic for beriberi. A special *katzang idjyo* milk is prepared and given to babies. It is also made into a flour, and Chinese shops sell this pea in the form of cakes and cookies. In the poorly irrigated districts of Java and Sumatra, when the rice crop is rotated with sweet potatoes, beriberi develops among the natives, and the Dutch government sends this *katzang idjyo* as a curative. Our prisoners of war in Burma were able to obtain some of this product and they report satisfactory results from its use on beriberi patients.

Hypertension was seldom encountered among prisoners of war. Blood pressures of at least 1,500 prisoners were taken. It is rather difficult to explain this phenomenon. Several factors must be considered. In the first place, most of the men had normal tension prior to the war. Many of the merchant seamen of advanced age may have been hypertensive prior to the outbreak of hostilities, but they failed to show any evidence of hypertension during their captivity. Marked diuresis was experienced by almost all prisoners. The rice diet may have been a factor, probably the most important factor. It is a well known fact that the Japanese and the Chinese rarely develop essential hypertension. Many of the Japanese examined by necropsy at Saipan failed to show any evidence of atherosclerotic changes in the aorta or coronary vessels. It is possible that some antipressor substance is present in rice, which prevents or diminishes the tendency for vasospasm in the small arterioles throughout the body, and thus prevents subsequent development of essential hypertension.

It has been reported that eye-ground changes (so-called hypertensive neuroretinopathy) disappeared on a regimen of a rice diet, fruit juices, and a caloric intake of about 2,000 calories. The low cholesterol in the diet may be of importance according to some investigations. It is probably possible that, just as the spasmophilic tendency exists in many patients, the hypertensive tendency may exist in others, and with improper diet, essential hypertension results. It has also been noted that many cases of essential hypertension have an abnormal capillary fragility, as manifested by the tourniquet test.

Blood protein levels of returning prisoners of war, studied about 2 weeks after repatriation at Letterman General Hospital in San Francisco, were found to be normal. If hypoproteinemia plays much of a role in the pathogenesis of the edematous type of beriberi, it

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would seem that more prisoners would have manifested this syndrome. The body apparently has an amazing capacity to prevent the depletion of the total blood protein in the absence of glomerulonephritis, and even in the presence of liver damage.

A most remarkable clinical picture observed among prisoners of war was the so-called "burning feet syndrome." This condition, called *chachaleh*, has been observed in Somaliland and is apparently clinically related to beriberi. It is characterized by marked burning of the ventral and dorsal aspects of the feet, accompanied by a sensation of numbness, and in many cases severe pain in these regions. The feet felt hot to the touch, were very painful, and had a cyanotic, bluish-purple color. The area of pain rarely extended above the ankles. An accompanying polyneuritis of the legs and reflex changes as seen in dry beriberi was often observed. This condition occurred in camps in Java and Macassar as well as in Japan. The only relief from pain was obtained by exposing the extremities to cold, either by immersion in cold water or by exposing the feet to the elements. Some of the patients with this syndrome kept immersing their feet in ice water or water chilled by snow, with resulting dry gangrene and spontaneous sloughing of one or two toes, and one man had to have amputation of both legs, because of the gangrene that ensued from this practice.

As the extremity becomes warmer, there apparently is an increased demand for oxygen, due to the increased metabolism of the local area involved, and pain is produced, possibly by the liberation of histamine. This syndrome of "burning feet" might be the clue to the relationship of the rice diet to the lack of essential hypertension, for it is definitely a vasomotor disturbance. Most of the patients with "burning feet" improved with massive doses of thiamine hydrochloride intravenously. Those patients who develop gangrene with spontaneous sloughing of the toes, were left with cold extremities due to diminished peripheral circulation. It might be postulated that those patents who develop this syndrome, among the many hundreds of beriberi patients, had a particular susceptibility to this disease because of poor vasomotor tone in the lower extremities.

Rarely was a case of acute rheumatic fever seen. Neurocirculatory asthenia was not observed, even though the factor of fear was present, for Tokyo was very severely bombed. Our patients with open pulmonary tuberculosis seemed to do fairly well on the protein-poor, fat-free, low-caloric diet. I was at a loss to understand how patients with extensive bilateral pulmonary lesions, many of whom showed multiple cavities upon x-ray examination, would have a normal temperature and pulse rate, and in many instances a normal or slightly elevated sedimentation rate. I was particularly impressed with this observation

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and when I returned to the United States, I was told that the ward medical officer in charge of the pulmonary tuberculosis cases at Fitzsimmons General Hospital felt that many of the former prisoners of war were not doing as well on the Stateside high-caloric diet as they must have been doing on their prison ration. It may be possible that by starving the host, the virulence of the acid-fast tubercle bacillus may be so attenuated that the disease becomes less active.

Excellent results were obtained in abdominal surgery, even though there was very little asepsis, for our home-made steam sterilizer was inadequate and our gloves were merely dipped in creosote solution, plus the fact that both the air and operating room were constantly being contaminated by dust and dirt. We applied sulfanilamide intraperitoneally, and along the closure planes in all cases, using about 10 grams for each case. There was no postoperative peritonitis, very little abdominal distention, and no stitch abscesses appeared. Occasionally a patient would become moderately cyanotic but this would disappear in a few days.

Spinal anesthesia and pentothal sodium intravenously were used. The sulfa drugs were used extensively, locally and orally, and there was seldom an untoward reaction from their use. The blood and the urine were checked in most cases. The surgeon felt that the use of



4. One of the first boatloads of prisoner patients to be evacuated from Shinagawa being taken aboard the U. S. S. *Benevolence.*

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intraperitoneal sulfanilamide, because of an increase in serous ooze, possibly delayed wound healing, but it was used because of lack of aseptic facilities. An interesting observation is that men who in ordinary times would be considered very poor surgical risks because of their emaciation, their amebiasis, and their vitamin deficiencies, responded very well under surgery. In fact most of them sat up and asked for rice in about 36 hours. There were no cases of pulmonary embolism, for the patients were moved about a great deal postoperatively, and the home-made bedpans required considerable lifting of the patient.

Approximately 300 cases of amebiasis, both cystic and vegetative forms, were treated with all the known amebicides with very disappointing results. It appeared that adequate food or other factors were required to combat the amebiasis. Cases of bacillary dysentery were diagnosed by the finding of pus cells, macrophages, and erythrocytes in stool specimens, and they responded very well to large doses of sulfaguanidine, 4 grams orally every 4 hours for 4 doses a day.

The pellagrous patients improved on nicotinic acid by mouth. Very few cases of active malarial infection were seen. Intestinal parasitic infections were very numerous, and they responded poorly to treatment.

SUMMARY

1. Approximately 1,100 prisoners were treated between July 1943 and March 1945, with a mortality of only 66 patients.

2. The endocrinologic aspects of avitaminosis have been emphasized, especially the disturbance of the liver, thyroid, pituitary, and adrenal glands.

3. The difference between the acute and the chronic phase of malnutrition has been emphasized.

4. Beriberi appears to be a multivitamin deficiency disease and further study is necessary in order to determine its pathogenesis, course, and treatment.

5. The vasomotor aspects of beriberi have been enumerated, with the possible relationship to the lack of hypertension among the rice-eating races.

6. The relationship of diarrhea to the edematous type of beriberi has been stressed.

7. Retinal degeneration due to vitamin B_1 deficiency did not respond well to vitamin B_1 therapy. Xerophthalmia responded favorably to cod-liver oil treatment.

8. The average weight loss among prisoners of war was approximately 40 pounds.

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9. Intraperitoneal sulfanilamide was used very extensively in abdominal surgery with very favorable results.

10. The possible beneficial effects in cases of pulmonary tuberculosis of a low-caloric, low-protein, fat-free diet has been suggested.

11. Poor results were obtained in the treatment of amebiasis.

12. Untoward reactions to the sulfa drugs were seldom observed among prisoners of war.

13. A high incidence of acute infectious hepatitis occurred. Acute rheumatic fever was very rare.

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HEPARIN IN PENICILLIN THERAPY

To prevent thrombosis or thrombophlebitis, the addition of heparii to the penicillin solution proved to be of undoubted value where the continuous intravenous drip method was used. The dosage employed is 3 units per cubic centimeter of penicillin solution, the heparin being added to the solution in the bottle. Should thrombosis occur, as it may occasionally, the next bottle is charged with 5 units per cubic centimeter.—MARTIN, P.: Heparin in penicillin therapy. Biol. Abstracts **20**: 41, January 1946.

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EXAMINATION OF HUMAN TYPE MYCOBACTERIUM TUBERCULOSIS WITH THE ELECTRON MICROSCOPE

Examinations of human, avian, and bovine tubercle bacilli have been made with the electron microscope. Vacuoles, granules, and microgranules can be distinguished in the human type, being more apparent in older cultures, while in very old cultures the bacilli appear as empty sacs, having lost their morphologic characters and their substance. Two types of granules are distinguishable, those resisting electronic radiations and others which seem to disappear under the influence of these radiations. Certain images give the impression that the resistant granules can leave the bacillary body and behave like spores.—WESSEL, E.: Examination of human type Mycobacterium tuberculosis with electron microscope. Vet. Bull. **15**: 383, December 1945.

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SEGREGATED TRAINING FOR RECRUITS WITH MINOR ORTHOPEDIC DISABILITIES AND COMPLAINTS

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Every medical officer in the Navy is familiar with the high percentage of complaints concerning the skeletal system and the frequent skeletal disabilities among Naval personnel. As a result of the great expansion of the Navy and lowering of the physical requirements, these complaints and disabilities were greatly increased, especially among men who were inducted.

Of the recruits entering training stations, many exhibit these minor disabilities and complaints and others develop them in training. To prevent this group from graduating from "boot camp," it became necessary either to survey an unduly large percentage or to apply remedial methods.

An experimental project was started on 15 August 1944 at the U. S. Naval Training Center, Farragut, Idaho, to improve the system of training in an attempt to produce physically better Naval personnel. In the usual system of recruit training many of these men fail to complete their course, are discharged, and hence are lost to the Navy, or continue in the Navy with constant complaints and with much loss of time in the sickbay. Generally speaking the minor disabilities and complaints are referred to the back, bones, joints, muscles, and feet. Under the old system of training, by which these men were distributed throughout the camp, it was difficult to apply the correct remedial measures.

Briefly the new principle applied here at Farragut was one of segregation of men with minor defects. This allowed easy access to these men for treatment, frequent observation, and early elimination of the unfit. There was a definite psychologic benefit to the segregated recruits. The recruit with a minor defect realized that he was not expected to compete physically with normal men until he was able.

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It also kept the bad example of disability from the impressionable normal recruits.

In addition to the usual orthopedic examination, an inquiry was made into the occupational history of the individual recruit and into the amount of competitive athletics or sports in which he had engaged in civilian life.

On the basis of this examination and inquiry the following groups of defects and complaints were segregated at the Receiving Unit:

1. *Spine.*—Deformities, congenital and acquired, of the spine, such as (a) adult and juvenile kyphosis, scoliosis, and lordosis not associated with active destructive disease processes; (b) torticollis, prespondylolisthesis, and early spondylolisthesis if asymptomatic; (c) spina bifida occulta; (d) sacralization of the fifth lumbar vertebra; (e) thin intervertebral disks without nerve root symptoms; (f) mild compression of the vertebral bodies at the dorsolumbar junction from osteochondritis without major deformity; and (g) old fractures if healed without major deformity.

2. *Extremities.*—(a) Healed fractures without complete restoration of function; (b) healed fractures with good function but with history of pain on over-use; (c) joints in which the recruit claimed periodic disability on the basis of recurrent sprains, recurrent dislocations, or internal derangements; (d) joints and extremities in which old diseases or injuries had become healed, but the recruit claimed lack of full function and symptoms on use; and (e) shortened extremities, congenital or acquired, in which the recruit complained of symptoms on use.

3. *Feet.*—(a) Flat feet, in which there was a history of heavy prolonged weight bearing without symptoms; (b) flat feet in which there was a history of foot strain on over-use only; (c) pes cavus of moderate degree with or without metatarsalgia or painful callosities; (d) foot strain and disability on over-use due to lack of development on the basis of a riding or sitting occupation in civilian life; (e) shortened calf muscle groups; (f) shoe fitting problems such as overlapping toes, bunions, and excrescences.

4. Complaints of disability not associated with deformities, loss of function or any evidence of organic disease. A few samples of this group are the backaches commonly seen in certain occupations such as truck driving and tractor driving and in those persons who complain of pain on doing any work.

5. Complaints in the sedentary, upper-age bracket of recruits. This group also included those younger individuals with poor athletic or occupational histories (quitting at each attempt at athletics or manual work). These men were poor risks unless given graduated training.

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6. Undiagnosed complaints. It is obvious that there is a certain amount of psychiatric overlap in those whose manifestations of symptoms are in the field of orthopedics. These recruits could be said to be diagnostic problems and were segregated for study in order to prove or disprove any organic disability. Many of these men were considered "trial duty" by the psychiatric department.

Records.—A record of complete diagnosis, classification and an outline of the suggested remedial program followed the recruit to his "boot camp." This record included the following data:

1. The remedial treatment recommended, such as surgery, immediate or delayed, special manipulations, and physiotherapy furnished through the regimental surgeon, and shoe corrections and instructions in proper walking habits, which were handled by the area chiropodist.

2. Special diagnostic problems, such as possible internal derangements of the knee and possible dislocated shoulders, were brought to the attention of the regimental surgeon.

3. A remedial physical fitness program (special corrective exercises) was prescribed by the orthopedic examiners for the purpose of restoring function of defective parts and relieving minor complaints.

Things which would tend to decompensate the partially disabled, such as excessive marching, excessive physical fitness training, including the obstacle course, were given to the orthopedic companies in graduated doses, with a view to not exceeding and gradually building up tolerance. Recruits for whom specialized remedial physical exercises had been prescribed, such as special back developing, quadriceps muscle developing, postural exercises, and exercises to increase motion in the joints, were instructed in these. They were frequently checked by the regimental surgeon as to their progress in restoration of function, or for complaints of aggravation due to over-use or improper procedure.

The administration of heat, massage, and simple harmless manipulations, similar to what is usually expected to be used in an athletic department, were carried out mainly by the medical department. However it is believed that the proper place for this is in the drill hall. It is not good to have these recruits reporting to the dispensary for this program. They shouldn't be reminded that they are in danger of becoming a medical casualty (in some cases they are hoping to do so as a matter of escape) and should not be exposed to the possibility of contagious disease.

The matching of these people for competitive games requires special consideration. By balancing those with defects so that they will not be totally overwhelmed by well-developed normal persons, the spirit of competition can still be used to motivate them. All those who by graduated training develop sufficiently to compete with the normal

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groups should be permitted to do so. The selection of intercompany competition should be such that a chance to excel is possible.

It can be readily seen that such a program requires close cooperation between the medical and the physical fitness departments. The men in these companies are given instructive and reassuring counsel to the effect that they are going to benefit by overcoming their defects and by developing themselves out of the disability class. They are told also that they will lose their uncomfortable symptoms by paying the price of cooperating in a program of development designed for them as individuals. We use the phrase "paying the price" because in the process of muscular rehabilitation one experiences some disagreeable symptoms.

RESULTS OF THIS PROGRAM

During the time that this program was in effect, 30,476 men were received and 33 companies of 100 men each were segregated. This program came into effect at a time when the war had been in progress for 2½ years. Hence many of these recruits had been reclassified for induction from the 4F group. The greater percentage were segregated for orthopedic reasons, although a few were put in the same companies for dental reasons or as psychiatric trial duties. This was not by choice but for convenience. The medical department found it easier to give these men remedial treatment and to give them special follow-up orthopedic re-examination under this system of segregation.

It proved very effective in the early elimination by survey of recruits with true disability before they became service-aggravated.

It cut to a minimum the number of recruits graduated who had so many subjective complaints that they were worthless as Naval personnel.

No recruit was graduated who had not gone through a satisfactory program of training with the same standard of physical fitness at the end of training that was required of the ordinary recruit. They had not been coddled. Men with defects that could not be corrected up to standard were not graduated. However, some men who had shown progress, but who had not become totally asymptomatic, were given more remedial exercises.

It was found that most of these companies developed to such an extent that they competed favorably with the regular companies, and some of them even won pennants in competition with the regular companies.

The only way accurately to evaluate the results of this program would be to follow this group of men through their Naval career and compare them with a similar group of physically defective recruits who had gone through the usual training.

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THE PSYCHOTIC NAVAL PRISONER[1]

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It is the purpose of this paper to consider the Naval prisoner who is hospitalized because of a psychosis. Despite screening procedures there are admitted to the service many men who seem unable to conform to the requirements of the group and soon become involved in disciplinary difficulties. In the majority of cases the problems to be considered are those of discipline, morale, adequate indoctrination, and intensive training in group activities. In some, however, the offense is a reflection of an inability to adjust to the group, based on intellectual or emotional defects.

In the Naval service an effort is made to detect the mentally-ill offender by repeated screening at the disciplinary barracks and by medical observation at all places of detention. The presence of a mental illness in the prisoner is of great concern, as, by virtue of the illness he may be held not responsible for committing the offense, or incompetent to stand trial, or too ill to serve sentence. The psychotic prisoner is immediately hospitalized, and after a period of observation has until recently been sent to St. Elizabeths Hospital, Washington, D. C. Such men are not committed to the hospital as "insane" but are ordered there for observation and treatment.

During the period from December 1941 to December 1944, thirty-four active duty Navy patients (2 Coast Guard, 9 Marine, 23 Navy) were admitted to the criminal division of St. Elizabeths Hospital. All of these men were general court-martial prisoners. Some had only been recommended for general court martial, others had been tried but not sentenced, while others were actually serving sentences. The illnesses necessitating their transfer to a hospital became manifest while they were awaiting trial, serving sentence, or in many instances they were a more obvious cause or accompaniment of the offense, thus leading to early hospitalization. The men were studied by the usual psychiatric interviews, supported by various psychologic tests and by social histories obtained from the nearest relatives.

These men were remarkable for their youth. Thirty three were less than 30 years of age, and 12 were under 20 years. The youngest was

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17 years, the oldest 42. There was only one officer in the group and of the remaining 33 only 5 were rated men (above the rate of seaman, first class, or corporal).

The majority of cases (23) had been hospitalized less than 1 month before transfer to St. Elizabeths; only 4 had been hospitalized more than 3 months before transfer. The time spent at St. Elizabeths was as follows: Less than 3 months, 5 cases; from 3 to 6 months, 10 cases; from 6 to 12 months, 15 cases; and more than 12 months, 4 cases.

In table 1 are shown the diagnoses of this group as established after an observation period of at least 1 month.

TABLE 1.—*Diagnoses of 34 general court-martial Naval prisoners at St. Elizabeths Hospital*

Psychopathic personality without psychosis		5
Psychopathic personality with psychosis		4
Dementia praecox:		
Hebephrenic type	1	
Catatonic type	1	
Mixed type	9	
Undifferentiated type	3	
	—	14
Psychosis with epilepsy		1
Psychosis with mental deficiency		1
Undiagnosed psychosis:		
(chronic alcoholism—syphilis)	1	
(prison reaction)	1	
(inadequate personality)	1	
(affective and schizoid features)	2	
no additional descriptive term	3	
	—	8
Psychoneurosis (mixed type)		1
Total		34

In table 2 the patients' courses in the hospital are summarized.

There is no question that all of these men had shown definite evidence of a mental illness before admission to St. Elizabeths Hospital. Nevertheless during their stay at that hospital 11 showed no evidence of psychosis and 17 showed only minimal residual symptoms of their illnesses. Twenty-eight of these men displayed no mental abnormality that necessitated any restriction beyond that afforded by the general wards of the psychiatric hospital. The transfer to this hos-

TABLE 2.—*Course in St. Elizabeths Hospital of 34 general court-martial Naval prisoners*

Course	Number of patients
Not obviously psychotic	11
Uneventful (only slight evidence of mental abnormality)	17
Grossly psychotic	6
Total	34

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pital was made so that all of the facilities of a large psychiatric institution would be available to the patient.

In table 3 is shown the condition of the patient at time of discharge from St. Elizabeths. The group marked "unimproved" includes 4 men who were discharged by court order in response to writs of habeas corpus prior to discharge from the Navy and thus were returned to custody in other Naval facilities.

TABLE 3.—*Condition on discharge from St. Elizabeths Hospital of 34 general court-martial Naval prisoners*

Condition	Number of patients
Not insane	6
Recovered	5
Social recovery	5
Improved	6
Unimproved	8
Retained	4
Total	34

Many of these men had served rather short periods of active duty prior to committing the offense which led to imprisonment or hospitalization. Only 10 had over 2 years of service, 19 had been on duty less than a year, and 15 less than 6 months. The shortest period of service was 26 days, and the longest was 7 years 8 months.

In table 4 are listed the offenses committed by these men.

TABLE 4.—*Offenses committed by 34 general court-martial Naval prisoners confined at St. Elizabeths Hospital*

Offense	Number of cases
Desertion (AOL or AWOL over 30 days)	14
Repeatedly AOL or AWOL	8
Homicidal assault	2
Striking officer	3
Disobeying orders, disrespectful language to superior officer	2
Murder	3
Fraudulent enlistment	1
Disobedience (set free prisoners under his guard)	1
Total	34

Only six of the men had committed crimes which clearly indicated their serious potential danger to society and hence necessitated strict prison supervision. The crimes of these six men were as follows:

1. Murder—three cases (in two of these cases all charges had been dropped before the men were hospitalized at St. Elizabeths).
2. Homicidal assault on a guard at Portsmouth Naval Prison.
3. Homicidal threats with knife, and previous criminal record.
4. Homicidal assault with gun during psychotic episode while on duty aboard ship.

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The intelligence of the majority of these men was measured at the hospital by the Stanford-Binet or the Wechsler-Bellevue scales. In a few cases intelligence was judged by school and occupational performance or by reports of intelligence tests made at schools or other hospitals. Table 5 shows the distribution of the members of this group by intelligence.

TABLE 5.—*Distribution by intelligence of 34 general court-martial Naval prisoners at St. Elizabeths Hospital*

Intelligence	Number of cases
Mental defective	1 (IQ 51)
Borderline defective	2
Dull normal	8
Normal	18
Superior	3
Very superior	2
Total	34

Of this group only 5 showed above average intelligence, and 11 were rated as dull normal or below.

Through histories taken from patients and relatives an effort was made to study the pre-service life of these men. The more significant facts obtained are listed under appropriate headings following:

The family background.—Twenty-four of the men were considered to have come from markedly unstable homes (marred by such things as alcoholism of one or both parents, divorce, illness, or parental strife). In six cases the father had deserted the family during the patient's early childhood. In five cases the father died before the patient was five years of age, and in three cases the mother had died during this period. In three instances the father was alcoholic and and in two the mother was alcoholic. Fourteen of the patients spent their early life in orphanages or the homes of foster parents.

Mental illness in the family.—In seven cases the behavior of the patient's father was so unusual that it could be considered as evidence of a mental illness. Examples of such behavior are shown next:

1. Peculiar, inadequate, seclusive.
2. Alcoholic, cruel, "peculiar."
3. "Shell shocked" in World War I with residual symptoms since.
4. Cruel, alcoholic, a bully—beat his children brutally.
5. Killed wife and committed suicide while his small children stood by watching.
6. A thief—deserted family—unstable.
7. Died while a patient in a mental hospital.

One mother displayed behavior suggestive of a psychopathic personality. Another mother died while hospitalized because of an illness diagnosed as catatonic dementia praecox.

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Previous mental illness.—Nine of the patients had displayed behavior that was definitely psychotic or strongly suggestive of a mental illness prior to entering the military service. These are summarized following:

1. Vague spells of amnesia.
2. Discharged from U. S. Army because of "mental deficiency and neurosis"—shortly thereafter (1942) in two State mental hospitals, where he was classified as undiagnosed psychosis.
3. Four enlistments in military service:
   a. USMC—18 months' service—1935 given undesirable discharge after 7 months AOL.
   b. U. S. Army—9 years' service—given medical discharge in July 1941 because of depression and suicidal attempt.
   c. USN—4 months' service—given BCD in May 1942 because repeatedly AWOL.
   d. USN—25 days' service—present enlistment (fraudulent).
4. Change of personality at 16 years, at which time private physicians made diagnosis of dementia praecox.
5. Frequent hospital admissions because of alcoholism and psychopathic behavior.
6. Marked mood swings.
7. Severe depression at 15 years—no medical care.
8. On several occasions saw psychiatrist who diagnosed "psychoneurosis."
9. Peculiar "spells" since age of 5 years—during such episodes was mute and exhibited bizarre behavior.

Only three of the group showed previous hospitalization because of mental illness.

Education.—In tables 6 and 7 are summarized the school records of these men.

TABLE 6.—*Formal education of 34 general court-martial Naval prisoners at St. Elizabeths Hospital*

School grade finished	Number of cases
Fourth grade and below	2
5th-8th grades	11
9th-10th grades	12
11th-12th grades	4
High-school graduates	3
1 year college	1
College graduate (AB)	1
Total	34

TABLE 7.—*Scholastic record of 34 general court-martial Naval prisoners at St. Elizabeths Hospital*

Record	Number of men
Poor	14
Fair	18
Good	2
Total	34

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Seven of the men were in much difficulty because of chronic truancy; nine were behavior problems in school and gave evidence of apparent early inability to conform to group requirements. As shown in table 6, 25 of the men had less than a tenth-grade education, and only 5 were high school graduates. Only 2 men showed good or superior academic work, the other 32 being rated as fair or poor.

Personality.—An attempt was made to separate these men into groupings indicative of certain terms commonly used to describe "personality types." The classification was made on the basis of a review of the social histories, personality studies, and observations made at the hospital.

TABLE 8.—*"Personality type" of 34 general court-martial Naval prisoners at St. Elizabeths Hospital*

Type	Number of cases
"Introvert"	24
"Extrovert"	6
Undetermined	4
Total	34

Nine of the men gave a history of enuresis beyond the age of 6 years, two being enuretic during the present illness. Four stuttered during childhood, four had frequent temper tantrums, and two suffered from night terrors.

Marital status and sexual adjustment.—Twenty-three of the men were single. Eleven had been married, but of these six were divorced, three separated, and only two were on good terms with their wives.

Twenty-seven of the men reported no gross sexual difficulties, but the study of the sexual life was admittedly superficial. Two men displayed marked conflict over masturbation; one had engaged in both heterosexual and homosexual activities and often secretly dressed in women's clothing; four apparently had never displayed any interest in sexual matters.

Antisocial activities.—Eleven of the men in this group had been involved in antisocial activities prior to entering the military service, as noted next:

1. Term for larceny—1934.
2. Threatened life of foster father and was reported to police.
3. Numerous juvenile court entries for theft, sexual advances to young girls and other petty crimes.
4. State Training School inmate—larceny.
5 and 6. Petty theft.
7. Grand larceny.
8. Theft and drunkenness.

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9. Disorderly conduct.
10 and 11. Misdemeanors.

Six of the men had been regular and heavy consumers of alcohol for some time prior to committing their military offenses. None of the patients gave a history of drug addiction.

Pre-service employment record.—Two of the men had worked only on the parent's farm or in his business. Eleven had never had any regular employment before entering the military service. Nine had shown a shifting occupational adjustment. Six had made a very poor work record, giving a history of being discharged, etc. Only six had a record of steady, satisfactory employment.

COMMENT

The "average man" in this group is young, single, and below the grade of corporal or seaman first-class. He is of about average intelligence, has completed less than 10 years of school with average or poor grades and only fair behavior. He came from an unstable home—an environment poorly suited for the development of the more desirable social traits. He is "introverted," has had some minor conflicts with the law, and has never held a job for any length of time. In the past he has shown symptoms of an unstable personality, having been enuretic beyond the age of 6 years, and being subject to marked mood swings. He found it difficult to adjust to the military service, had little motivation to support him during the difficulties of the training period, greatly resented discipline and any display of authority, and was repeatedly AOL and AWOL. He was sent to the brig and recommended for general court-martial, but while awaiting trial became depressed, tearful, seclusive, and displayed obviously abnormal behavior, with the result that he was sent to the sick bay and finally to St. Elizabeths Hospital. At that hospital he made a good adjustment, showing little evidence of psychosis and rapidly improving in an environment that, while restricting, was not punitive. After a few months in the hospital he was given an honorable medical discharge from the service and released.

This group is noteworthy for the lack of hardened criminals and for the comparatively minor nature of the crimes. It is a serious military offense to be AOL or AWOL, but in many of these cases the infractions of rules were a reflection of the individual's long-standing inability to make any prolonged adjustment to the restrictions of his group. In civilian life only a few of these men would have been sent to a criminal institution. In nearly all service cases charges are dropped at the recommendation of a board of medical survey and the majority of these men are then discharged from the hospital as soon as the military discharge is received.

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Some attention should be devoted to the group called "psychopathic personality." Like much of psychiatric nomenclature, this is a purely descriptive term, being applied to certain patterns of behavior which are manifest throughout the greater portion of the individual's life and first display themselves in early childhood. The cause or causes of such behavior are not known, but many authorities have considered "constitutional" factors to be of prime etiologic importance. It is well known, however, that similar behavior may be shown after cerebral damage from anoxemia, toxemia, or trauma. Recent studies have suggested that in some "psychopaths" there is a marked cerebral cortical dysrhythmia as demonstrated by the electroencephalogram, possibly indicative of cortical malfunction that interferes with proper social adjustments. Careful psychiatric investigation has shown that in some "psychopaths" the antisocial behavior may be explained by psychologic trauma experienced during the formative years.

It seems clear that "psychopathic behavior" cannot be explained on a single basis, but may result from one or more of a number of causes. It is probable that the term "constitutional psychopathic state" should be applied only to those individuals whose abnormal behavior has been manifest since early childhood and cannot be explained or understood despite careful medical and psychologic investigations. We question the validity of the term when applied to those with a history of severe cerebral trauma or those who spend their early years in social environments that would be obviously detrimental to the developing personality. There were nine men in this study diagnosed as psychopathic personality. Only two of these nine had a "negative" history and might be called "constitutional psychopaths." It is interesting to note that both of these individuals were reared in foster homes. The family background of the other seven is briefly summarized next:

1. Father was a drug addict and psychotic. Patient was cared for in foster home after the age of 8. At age of 5 he was unconscious for 7 days after a head injury and skull fracture.
2. Mother and father were divorced before patient was born. He was cared for in a series of private schools, having no home life, and becoming a spoiled, egocentric individual.
3. Patient was born after prolonged labor and use of instruments. He was unable to nurse and was fed by gavage during his first year. At 8 years had encephalitis, following which he showed marked personality change. In this case there is possible cerebral injury from two causes—birth injury and encephalitis.
4. Parents were separated when patient was infant and he was cared for by unstable grandmother. There was no parental supervision; governed only by peculiar, emotionally insecure elderly female. Patient made good school adjustment to ninth grade and his behavior was more that of a profound neurotic.

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5. Father died when patient was 5 years old. Stepfather was alcoholic, cruel, and abusive. Family was on relief and home life was torn by poverty, quarreling, and drunkenness.
6. Father was a "shell shocked" war veteran who deserted mother when patient was 5 years of age. Family was on relief and markedly insecure. Patient's IQ was 78. Here the patient is handicapped by poor home environment and a defective mentality.
7. Father had a violent temper, beat mother, and subsequently was sent to prison. Mother was sexually promiscuous and displayed "psychopathic" behavior. Parents were later divorced. Paternal grandfather was an alcoholic and a suicide. Patient never had security in a home which was marked by abuse and neglect.

It is very difficult in the cases listed to insist that these individuals bear a constitutional taint and are not rather products of extremely unfavorable environments. Constitution and environment cannot be (and should not be) entirely separated, but we believe that each case of "psychopathic" behavior should be carefully studied and the term "constitutional" used only with the greatest of caution.

It is interesting to note that six of the men insisted that they had "faked" their mental symptoms in order to escape punishment for their offenses. Three of these men were diagnosed as psychopathic personality, two as undiagnosed psychosis, and one as dementia praecox, mixed type. It is not uncommon for patients recovering from a psychotic episode to state that they assumed their symptoms and were not actually ill. Such action usually seems to be the result of fear and shame, the patient preferring to be known as a malingerer than as one who was psychotic. In these men there was no evidence of malingering, as all had shown definite evidence of profound personality disorders prior to coming to this hospital.

SUMMARY

1. During the period from December 1941 to December 1944, thirty-four general court-martial Naval (Coast Guard, Marine, Navy) prisoners were admitted to St. Elizabeths Hospital, Washington, D. C. as psychotic patients.

2. Twenty-eight of these men were below the grade of petty officer.

3. Thirty-three of the men were below 30 years of age; 12 below 20 years.

4. Nineteen of the men had served less than 1 year of military duty.

5. Only 5 of the men had more than average intelligence; 11 were rated as dull normal or below.

6. Twenty-four of the men came from markedly unstable homes.

7. Nine had shown evidence of a mental illness before entering the military service.

8. The majority had less than a tenth-grade education and had made only fair or poor scholastic records.

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9. Twenty-four were introverted, seclusive.

10. Eleven had previous criminal records, and only a few had a good work record.

11. In twenty-two cases the offense was AOL, AWOL, or a combination of the two.

12. In their inability to adjust satisfactorily to the military service the majority of these men displayed a chronic failure to make any lasting social ties—a reflection of rather profound personality defects.

13. These men are in need of rehabilitation, as nearly all are returned to the community when discharged by the military service.

14. An effort is being made to study each patient in terms of his personality structure, intelligence, and vocational interests. In this way these men will be guided into a suitable vocational training program when they leave the hospital, with the hope that they will thus be helped to find a more stable, productive place in society.

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PENICILLIN IN SUBACUTE BACTERIAL ENDOCARDITIS

Although penicillin appears to be a promising cure for subacute bacterial endocarditis, patients who recover from this disease are left with the same or further valvular deformities, which continue to predispose them to reinfection or to subsequent congestive heart failure.

The successful treatment of a patient with subacute bacterial endocarditis is an individual problem that requires careful attention to the details of therapy. Successful treatment depends on maintaining penicillin blood levels considerably in excess of the minimal inhibiting concentration of penicillin for the patient's organism.—FAVOUR, C. B.; JANEWAY, C. A.; GIBSON, J. G.; and LEVINE, S. A.: Progress in treatment of subacute bacterial endocarditis. New England J. Med. 234: 71–77, January 17, 1946.

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SYNERGISTIC ACTION OF NICOTINAMIDE UPON PENICILLIN

High concentrations of nicotinamide exert a synergistic effect upon penicillin inhibition of Staphylococcus aureus. Nicotinic acid was inactive in this respect. No evidence for a reaction between nicotinamide and penicillin could be found. Although the effect of nicotinamide appeared to be general for the 3 strains of staphylococcus tested, no effect could be demonstrated upon either Streptococcus pyogenes or E. coli.—FRIEDEN, E. H.: Synergistic action of nicotinamide upon penicillin. Proc. Soc. Exper. Biol. and Med. 60: 352–353, December 1945.

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THE MENTAL DEFECTIVE AND THE UNDER-AGE MAN IN THE NAVY

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Probably one of the most difficult groups of individuals to be understood by the layman, and the most often mishandled through such misunderstanding, is the mental defective group. Because their severe limitations are so frequently obscured by their age, and by their often average and pleasing appearance, these individuals are commonly considered merely "delinquents."

The world of the mental defectives is a simple world, due to the limitations of their abilities to learn new things, to comprehend what takes place about them, to retain and assimilate cultural stimulations, and above all to be able to be self-directive in a new setting. An attempt to force such an adaptation upon these individuals is made when they enter the service. The degree of difficulty resulting from the strangeness or unfamiliarity of this new setting, as well as the understanding of the officers or men in charge of them, determines to a great extent how they will adjust themselves to this new life and its demands. Because of the wide contrast between their simple civilian cultures and the complexity of a mechanized war, their adaptation to productivity for the armed forces is more or less a failure. The amount of supervision and direction required by them is not commensurate with their output for service.

Often the mental defective who has escaped recognition during the early part of his Navy career eventually becomes a disciplinary case. He probably will respond to the mild discipline administered for his petty offense, both the offense and the purpose of the discipline being understood by him. Many times, however, other offenses committed have childlike motivations, and since his own childlike reactions to the thwartings are stronger than any sense of duty that he could comprehend, he easily becomes a serious Naval offender, chiefly AOL (Absence Over Leave) or AWOL (Absence Without Leave). His misfitness becomes an ever-present administrative problem, when he is retained in the service. The few who have not become involved in discipline might well be those whose assignments are yet quite simple

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and in line with their aptitudes. Acceptable efficiency on a low routine job must not presuppose a universal and versatile efficiency.

The aim of this article is to present briefly some important factors peculiar to the mental defective with the implications of these factors in the disciplinary handling of the individual. The almost parallel problem of the under-age offender in the Navy will also be considered.

Mental deficiency is considered as a state of (1) social incompetence resulting from a state of (2) mental growth arrestment which has been (3) developmental in nature. When these criteria have been satisfied, a diagnosis of mental deficiency can be advanced.

Psychometric test scores have tended to supplant the above criteria for mental deficiency. These scores must be handled and interpreted very carefully to be of any value.

Among the many psychologic tools devised for the purpose of measuring the attributes of human beings, the tools that measure personality are gradually proving to be helpful. Similarly tools for evaluating individual social competence or social maturity have been developed which are useful in establishing the state of incompetence among the mentally deficient, mentally ill and delinquent. The Vineland Social Maturity Scale developed at the Department of Research, The Training School, Vineland, New Jersey, has been and is probably the most successful to date. This scale permits the measurement of social development from birth up to maturity, a 25-year range. The degree and kind of incompetence is measurable and expressable in Social Age (SA) and Social Quotient (SQ) units. This tool offers a means of establishing the initial criteria of mental deficiency, as well as a point of departure for any psychologic problem of adjustment.

A detailed item analysis was made of the social competence (Vineland Social Maturity Scale) and of the mental competence (Wechsler-Bellevue Scale of Intelligence) of 35 mentally-defective enlisted men, many of whom were Naval offenders. The ages of the men in this group ranged from 16.5 years to 38.8 years. The diagnoses were not made on the fallacious "I. Q.," but were based on the criteria involved in the total definition of mental deficiency.

SOCIAL COMPETENCE

Social competence refers to the capacity of the individual to carry on the minimum essentials of everyday living without supervision or direction of others. This independence develops with and is measured according to progressive age levels, as is the development of intelligence. On the Vineland Social Maturity Scale this briefly includes: (1) Self-help items (general, eating, and dressing); (2) self-direction; (3) occupation; (4) communication; (5) locomotion; and

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(6) socialization—all common elements and minimum essentials to any individual's development to complete adult maturity or independence.

The analysis of the social maturity of the 35 mental defectives revealed that there were 8, or 23 percent, who did not carry out the bathing routine (not just showers) without the aid or supervision of wife or some member of the family; 2, or 6 percent, who could not comb and part their own hair; and 28, or 80 percent, who required assistance in completing the self-dressing routine (several were unable to tie their own neckties and neckerchiefs). All of these minimum essentials are perfected by normal children in from the 8th to 13th year.

Of this group, 12 or 35 percent, were not trusted to go about their own home towns unaccompanied by parents, wife, or other trustworthy member of the family; and there were only 9, or 26 percent, who were capable of going outside the limits of their home town to relatively unfamiliar places and of being responsible for their own arrangements. None of the 35 have traveled alone to remote towns or places. None was permitted to go out unrestrictedly at night and 29, or 82 percent, required supervision during the daytime.

Eight, or 23 percent, were unable to tell time to a quarter-hour accuracy. Thirty-four, or 97 percent, were able to perform routine household tasks under their own responsibility, while only 19, or 54 percent, reported work done about the neighborhood that merited payment, such as gardening, household tasks, or simple farm jobs. Twenty-two, or 62 percent, were performing some simple creative work on their own initiative such as making simple useful articles, doing simple repairs, gardening, raising pets, or sewing. Only 3, or 9 percent, were performing responsible routine chores such as family chores, assisting in housework, or gardening. Thirty-four, or 97 percent, had not been gainfully employed at such occupations as servants, farmhands, laborers, or factory help, usually expected of boys and girls of 18 years of age.

Thirty-two, or 91 percent, of these individuals were able to write or print legibly their first name or full name without using copy, while 23, or 65 percent, were unable to write simple words from dictation, and 33, or 94 percent, were unable to write well enough to prepare brief notes to friends or relatives. Only one was capable of making a phone call without help.

Only 20, or 57 percent, were capable of handling money and making simple change in the purchase of useful articles, and had had experience in doing so; 31, or 88 percent, did not select or purchase minor articles of clothing such as socks, underwear, shoes or shirts, but had this done for them by mother or wife.

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Thirty-one, or 88 percent, did not have their own spending money, amounting to a dollar or so per week, to spend on their own initiative or discretion. Inability to make simple change in small amounts is a not uncommon finding.

Five, or 15 percent, were unable to participate in simple table games observing rules; and 10, or 29 percent, did not engage in cooperative play such as baseball.

Sixteen, or 46 percent, still held to the belief in Santa Claus, and spoke enthusiastically about his reality.

These men are still small children in their capabilities, and their adjustment to the Naval service has resulted in numerous administrative problems.

The social age and social quotient were calculated on each of these individuals. The range of social ages was from 6.3 years to 14.4 years, with social quotients from 31 to 69. These individuals, despite their real-life ages (range 16.5 to 38.8 years), are children ranging from childhood to preadolescence in degree of social maturity or independence, even with due consideration given to any influence a subcultural background may have had.

MENTAL COMPETENCE

A detailed item analysis was made of the quantity and quality of mental capacities measured by an individual intelligence test, but the findings are not reported here in detail. Mental incompetence also was revealed in all the cases on the Weschler-Bellevue Scale of Intelligence.

Social maturity and mental competence of 35 mental defectives

	LA (Life age)	SA (Social age)	SQ (Social quotient)	MA* (Mental age)	IQ (Intelligence quotient)
Range	16. 5–38. 8	6. 3–14. 4	31–69	6. 0–10. 0	35–69
Mean	22. 68	9. 93	47. 79	8. 59	56. 43
Mode	18. 0	10. 5	52	9 5	55

*Weschler, D.: The Measurement of Intelligence. The Williams & Wilkins Company, Baltimore, Md., 1939, p. 122.

Another group causing numerous administrative problems is the under-age enlistment group. These youths have falsified their ages, and sometimes their names, but because of some physical precociousness have been believed and have been taken into the Navy.

The study of the development of intelligence from birth to its maturity shows that intelligence reaches its growth at about 14 to 16 years of age, as measured by the best standardized tests, although there may be improvement in the quality as maturation goes ahead. Hence

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for the normal under-age enlisted man it is highly probable that he reached his normal peak of mental development at 16 and will change but little in development when of adult age. Although he is poorly experienced for adult responsibility because of his youth, he might well be responsible for most of his actions as a Naval offender from the intelligence angle, providing there are no other psychologic anomalies of behavior and development present. In the normal well-adjusted 16-year-old lad, social maturity or social competence is quite apt to be at his normal life-age expectancy level, or even slightly above, providing there are no other complicating factors or circumstances.

With the mental defective, and especially with the group in whom the causation is endogenous (since few exogenous types enter the Navy), the picture is quite different. Intelligence here develops more slowly and reaches its low peak of maturity at different life-age periods. The peak of intelligence growth often hovers between the mental ages of from 9 to 12 years, and often below these age levels. Even with adult-life ages the mental ability has remained that of a child of the preadolescent level of development. Despite his real-life age, this level of intelligence and comprehension limits his ability to benefit or assimilate new experiences thrust upon him, when these experiences are at an adult level of expectation. It is not surprising that this is difficult for the layman to understand, because these mental defectives appear so mature physically, strong and often good looking, and yet are children of from 6 to 10 years mentally and in experience. Similarly the social maturity or social competence of these individuals reveals that they are living and adjusting as children in an adult situation. With the conflict that results when demands of the adult or preadult levels are thrust upon children, the reactions are usually failure, disinterest and escape to a simpler level of adjustment. This, also, often is interpreted by the layman as planned delinquent behavior and severe discipline is given.

From this brief description the following questions might be raised:

1. As the Navy does not desire to take into the service normal boys under the age of 17 years, is it justified in retaining in the service mental defectives whose abilities are those of children much below that age?

2. The mental defective who enters the Navy offers to the service the best that he has. Since this "best" is too little to be useful to the Navy and of a quality which the Navy neither needs nor wants, should he be disciplined for this shortcoming over which he has no control?

3. Since mental deficiency and the resulting incompetence are inherent in the mental defective, long confinement as part of a disciplinary measure will not change the abilities to the extent of making him useful in the Navy. Should this not be considered in dealing

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with mental defectives who are given courts-martial with confinement and possible restoration to duty?

4. The normal under-age enlisted man who becomes a Naval offender may possibly be granted clemency on account of his age, but being of normal intelligence and competence at his age level, might not discipline strengthen him and improve his maturity for the service?

5. Since age, intelligence, personality and physique are so often misleading in evaluating men, does not social maturity become a very important psychologic consideration?

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PENICILLIN YIELDS FROM NEW MOLD STRAINS

Following ultraviolet irradiation of spores from a monoconidial isolate of the well-known strain X–1612 of Penicillium chrysogenum, a promising new strain, Wis. Q176, was obtained in June 1945. This has consistently surpassed its parent in penicillin production, usually by a considerable margin.

It will be seen that although shake flask yields varied considerably in every experiment, both Q176 and Q176A8 surpassed X–1612. In the tank tests Q176 gave yields higher than those thus far obtained with any other culture. Q176A8, however, failed to surpass X–1612.

The fundamental studies on variability in Penicillium notatum and P. chrysogenum of which these strains were a byproduct, will be reported in detail elsewhere. Upon request, transfers of any of of the cultures mentioned in this note will be sent to laboratories engaged in penicillin research or production.—BACKUS, M. P.; STAUFFER, J. F.; and JOHNSON, M. J.: Penicillin yields from new mold strains. J. Am. Chem. Soc. **68**: 152–153, January 1946.

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REGULATORY EFFECT OF ADRENAL CORTICAL EXTRACT ON ELABORATION OF PITUITARY ADRENOTROPIC HORMONE

Administration of cortical extract prevents the decrease in adrenal ascorbic acid which accompanies exposure to cold but does not prevent the decrease which results from administration of exogenous adrenotropic hormone. Since reduction in adrenal ascorbic acid is initiated by pituitary adrenotropic hormone, cortical extract must act to inhibit elaboration of this tropic hormone by the pituitary. These results have been interpreted to mean that rate of release of adrenotropic hormone from the pituitary is regulated by the concentration of adrenal cortical hormones in the blood and tissues.—SAYERS, G., and SAYERS, M. A.: Regulatory effect of adrenal cortical extract on elaboration of pituitary adrenotropic hormone. Proc. Soc. Exper. Biol. & Med. **60**: 162–163, October 1945.

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METHOD FOR PRACTICING PREVENTIVE PSYCHIATRY IN A NAVAL PERSONNEL SEPARATION CENTER

LESTER L. HASENBUSH [1]
Lieutenant, junior grade (MC) U. S. N. R.

The chief function of the medical department of a Naval personnel separation center is to aid in the separation of men from the Navy at a maximum speed by rapidly finding and reporting the physical and mental disabilities of separatees (with emphasis on disabilities incident to or aggravated by service conditions). In our opinion, however, the psychiatric division in such a medical department, in addition to its function in finding and reporting neuropsychiatric problems constituting disabilities, is in a position to make an important further contribution to the work of the separation center along the following lines: (1) Information as to the services offered in local communities by psychiatric clinics and by other facilities for the rehabilitation of veterans can be given to men who have psychoneurotic reactions calling for more or less intensive treatment but who are not so disabled as to warrant delaying their discharge for such treatment; (2) Many "normal" separatees with less deep-seated personal adjustment problems can be provided with effective mental hygiene through brief interviews in the psychiatric division itself; [2] and (3) Data of psychiatric interest concerning separatees can be collected and evaluated.

In a Naval separation center the large numbers of men being discharged (or returned to inactive duty) each day and the rapidity with which these men must be examined have led to mass physical and laboratory examinations of an "assembly line" type. The psychiatrist is last in the line of medical examiners in order to have the benefit of reviewing the results of the general medical examinations. However, because the psychiatric division usually has very few psychiatrists and no available trained psychiatric assistants, such as psychologists and social workers, it cannot provide even 3-minute interviews with

[1] With the assistance of Grace G. Hasenbush, B. A.

[2] The Civil Readjustment Services available in separation centers deal with problems involving the rights of veterans, education and vocational planning, and the like, but do not provide for phychiatric interviews.

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each separatee. Certainly no time would be available for providing the services outlined if every dischargee were to be seen by the psychiatrist. For this reason, at the Naval Personnel Separation Center, U. S. Naval Base, Bremerton, Washington, where only one psychiatrist is permanently assigned, the psychiatric division has been organized so as to utilize the capacities of the psychiatrist as fully as possible.

A screening process has been devised to select separatees for interview with the psychiatrist on the basis of one or more of the criteria from the following three records. This screening is performed by four hospital corpsmen trained by the psychiatrist.

1. *The health record.*—This detailed report of a man's medical history, and clinical and laboratory findings from the time of his induction or enlistment to the time of his separation from the Navy is, with few exceptions, available for every man. The hospital corpsmen are trained to select for interview with the psychiatrist all men whose health records reveal that during military service they have had a diagnosis of (a) neurologic illness (including various forms of neurosyphilis and intracranial injuries), (b) psychiatric disability (including combat or operational fatigue), or (c) disorders such as irritable colon, chronic lumbar myositis, and tachycardia, which often have important emotional components.

2. *Naval medical department Form Y (1939).*—This is the report of physical and laboratory examinations as made in the separation center. To aid in conserving the psychiatrist's time, abnormalities of station, gait, speech, reflexes, and fine movements are recorded by previous examiners. The hospital corpsmen are trained to refer to the psychiatrist for further neurologic examination and evaluation any man whose Form Y shows such deviations. They select for psychiatric interview the men whom previous medical examiners recommend for such interviews and also men whose reports show possible psychosomatic illness.

3. *A psychiatric questionnaire for separatees.*—This has been compiled by the psychiatrist to serve as a self-administered means of obtaining information of psychiatric interest concerning each separatee. Its present form evolved gradually out of our experience. It is sufficiently concise to be printed on one side of an 8- by 13-inch sheet of paper. The questions were carefully framed so as to be easily understood, and those that proved confusing were altered. Some of the questions are quite broad and general in scope so as to screen out, with a brief questionnaire, not only separatees with psychoneurotic reactions or neurologic disorders, but also "normal" men with lesser concerns that might prove significant in terms of mental health. The following form of the questionnaire is being used at present.

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MEDICAL DEPARTMENT, U. S. NAVAL PERSONNEL SEPARATION CENTER

PUGET SOUNG NAVY YARD, BREMERTON, WASHINGTON

PSYCHIATRIC QUESTIONS FOR SEPARATEES

Last Name (Print)_____ Initials_____ Rate_____ Age_____
Birthplace_____ No. of School Grades Completed_____
Single_____ Married_____ Ever Divorced_____ Wife Dead_____

AFTER COMPLETING THE ABOVE, READ CAREFULLY BELOW

The following questionnaire deals with your personal life and general health. The doctors don't have much time to talk with each separatee. Therefore, if your answers show that you have some worries, you will have a chance to talk things over with a doctor who may be able to give you some hints on how to help yourself to get squared away.

This is NOT A TEST. There are NO RIGHT OR WRONG ANSWERS. Your answers will be kept CONFIDENTIAL and will NOT become a part of any official records. Answer TRUTHFULLY to the best of your ability. NONE OF YOUR ANSWERS WILL IN ANY WAY BE HELD AGAINST YOU.

Just make an "X" after each question in the column under Yes, No, or I Don't Know, according to which answer applies best to YOU. DON'T RUSH, but your first hunch as to the answer is probably the one you should put down. Please answer ALL the questions. Look at the SAMPLE LIST on the wall or talk to the corpsman if you don't understand what to do.

	Yes	No	I Don't Know	
1. Have you had *more than* 35 months of active service since 1 Sept. 1939?				1
2. Have you served overseas?				2
3. Have you been overseas *more than* 17 months since 1 Sept. 1939?				3
4. Have you taken part in at least one major engagement				4
5. Are you a survivor of a ship that was hit in enemy action?				5
6. Have you *ever in your life* been knocked out (unconscious)?				6
7. Have you *ever* been arrested for anything other than minor traffic violations?				7
8. Have you had malaria, filariasis (mumu) or a *serious* disease, wound, injury or operation in the service?				8
9. Have you some ideas about what kind of work you want to do after you leave the service?				9
10. Will you live in the state where you lived before you joined the service?				10
11. As a civilian did you live chiefly in rural areas (places under 2,500 population)?				11
12. In 1939 was your home still in the state where you were born?				12
13. Were you usually happy during your childhood?				13
14. Do your stomach and bowels usually feel well and work all right?				14

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	Yes	No	I Don't Know	
15. Does your heart worry you?				15
16. Do you get bad head or neck aches more often than once a month?				16
17. Do your back and limbs usually feel all right and work well?				17
18. Do you often get shaky or sweat for no reason that you can understand?				18
19. Do you sometimes get dizzy or have fainting spells?				19
20 Are you bothered with serious eye, ear, nose, or throat trouble?				20
21. For your age, do you think that you get tired too easily?				21
22. Do you usually sleep well?				22
23. Is your appetite usually all right when you have good chow?				23
24. Are you worried about some sex problems?				24
25. Are you bothered by crowds or noisy places?				25
26. Do you often lose your temper?				26
27. Do you find it difficult to make friends?				27
28. Have you any fears that you don't understand very well?				28
29. Have you any unpleasant thoughts that keep coming back?				29
30. Are your feelings easily hurt?				30
31. Can you usually keep your mind on what you are doing?				31
32. Do you feel that you've had a raw deal?				32
33. Is your memory usually fairly good?				33
34. Are you usually cheerful and in good spirits?				34
35. Have you been nervous for months at a time?				35
36. Do you believe that most men of your age are better men than you?				36
37. If you can get it, do you drink two quarts of liquor (or more) a week?				37
38. Have you had *more than* two courts martial in the service?				38
39. Have you any *serious* worries about family matters?				39

If you want to see a doctor about something that worries you, write in a few words below (or tell a corpsman) the general subject you want to take up.....

The simple introduction that follows the brief identifying data seems, in general, to have been successful in explaining to the separatee the possible usefulness of the questionnaire to him and in encouraging him to answer the questions frankly. The identifying data and questions No. 1 through No. 13 were designed primarily to provide the psychiatrist with a few succinct clues as to the background of men interviewed; unlike the remainder of the questionnaire, these are not

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used as a basis for selecting men for psychiatric interview. Questions No. 14 through No. 24 were framed to obtain information concerning somatic preoccupations or symptoms of possible neurologic or psychosomatic significance. In conjunction with this group, questions No. 15 through No. 39 were intended to elicit manifestations of deep-seated psychiatric problems as well as of personal adjustment difficulties in relatively normal men.

It is to be noted that certain specific questions referring to enuresis, drug addiction, a history of mental illness, and the like, which are commonly included in psychiatric questionnaires have been omitted. Our experience indicates that such problems usually come to the attention of the authorities during the course of a man's military service and result in his discharge long before he is due to reach a separation center.[3]

As each separatee reaches the psychiatric division, he turns over to a hospital corpsman his health record and Form Y and in turn receives a questionnaire. The hospital corpsman gives him individual instruction to read and fill it out in one of the adjoining rooms. Questionnaires are answered in three fairly quiet rooms, each provided with a large enough table to allow each of six men to write with some privacy. A man is given as much time as he needs, but most men finish in less than 10 minutes.

After a questionnaire has been answered, a hospital corpsman, using a stencil, checks it in a few seconds and selects to see the psychiatrist men with answers falling into any one of the following categories: (1) An affirmative response to question No. 24 indicating worry about some sex problem, or to No. 39 indicating serious worries about family matters; (2) Six or more "significant" responses to questions No. 14 through No. 39 inclusive (often there is an affirmative response to question No. 24 or No. 39 among the six or more "significant" responses which results in overlapping of these two criteria); (3) Five or more "I don't know" answers on the entire questionnaire; and (4) A request to see the doctor. If such a request is made by a man who would otherwise not be interviewed, the hospital corpsmen inquire as to the general nature of the problem that the man wishes to discuss if this has not been indicated at the end of his questionnaire. Then the hospital corpsmen select for interview with the psychiatrist men wishing to discuss matters pertaining to his field and refer elsewhere in the medical department separatees with surgical or medical problems having no obvious psychosomatic implications.

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[3] It is possible, of course, that occasional men with problems of these types are able to conceal them successfully and to function adequately in the Navy. Such persons could also easily elude detection in their brief contact with the medical department of the separation center.

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If the hospital corpsmen select a separatee for interview with the psychiatrist, the health record, Form Y, and questionnaire are sent with him to the interview. All others pass through the medical department without seeing the psychiatrist.

The screening process is sufficiently flexible to bring to the interview a fairly constant number of separatees hourly. On the average the psychiatrist sees 5 or 6 men an hour. This represents from 10 to 12 percent of the usual number examined in the medical department. When more than this number of men are being examined, the proportion reaching the psychiatrist can be decreased, for example, by using the questionnaire to screen for interview men with 9 or more (instead of 6 or more) "significant" responses. The flexibility of the screening process also permits the psychiatrist to reach for investigative purposes, in addition to those ordinarily screened, special groups of separatees, such as men who have a past history of having been "knocked out," and men with gastro-intestinal complaints.

To aid in evaluating the screening process, 300 consecutive interviews of men screened routinely were analyzed. Of these only 42 (14 percent) revealed no problems in neurology or preventive psychiatry. Men with interviews falling into this group either had a combination of "significant" responses which on discussion proved of no real significance in adversely affecting personality, had problems which were primarily medical or surgical, answered questions carelessly, misunderstood them, or were illiterate. Two hundred fifty-two men (84 percent) had problems involving their personal adjustment. Of these only one (0.3 percent) required transfer from the personnel separation center to a naval hospital for treatment and eventual medical discharge because of a serious psychiatric disability (paranoid state). Six men (2 percent) had problems primarily of neurologic nature.

With regard to the proportion of the men reaching the psychiatrist through each of the three records used for screening, it was found that 273 (91 percent) were selected on the basis of one or more of the criteria obtained from answers to the questionnaire, 31 (10.3 percent) on the basis of one or more of the criteria outlined in connection with the health record, and 7 (2.3 percent) on the basis of one or more of the criteria discussed in connection with Form Y. A scattering of men were screened for interview because of findings in more than one of the three sets of records.

Of 273 men screened out on the basis of the questionnaire, 161 (58.9 percent) showed "significant" responses to 6 or more questions between Numbers 14 and 39 inclusive, 95 (34.8 percent) answered questions No. 24 or No. 39 (or both) indicating worries concerning sexual or family matters, 5 (1.8 percent) answered 5 or more questions with "I don't know," and 59 (21.6 percent) requested to see the doctor. As the total of these various percentages is 117 percent, it is apparent that a num-

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ber of the men fulfilled more than one of the criteria for selection for interview.

To further evaluate this screening process, 100 separatees with questionnaires showing not more than 2 "significant" responses to questions Numbers 14 through 39 were selected for interview from the group of men who would ordinarily not reach the psychiatrist. These men were interviewed with the same care and technic employed with those who were referred through the screening process. In none of these 100 men was there any recognizable neurologic disorder, or deep-seated personality difficulty requiring hospitalization prior to separation or referral to a psychiatric clinic or related facility after return to civilian status. Seven (7 percent) appeared to be "normal" persons wth problems in personal adjustment such as can be profitably discussed in a brief mental hygiene interview. Thus it was felt that, because of the emotional stability and maturity of this group as a whole, and because of the reluctance of some of these men to see the psychiatrist, these 100 separatees had little to gain from preventive psychiatry or neurology. This is in contrast to the high percentage (86 percent) of the 300 men who reached the psychiatrist as a result of the screening process.

The screening process thus appears to be effective in bringing to the psychiatric examiner a high percentage of the separatees with personal adjustment problems that they are willing to discuss in this situation. It is not within the scope of this article to discuss in detail the types of problems encountered or the psychiatric technics that have proved especially useful in single brief mental hygiene interviews. It might be noted in passing, however, that at the separation center most of the men are seen at a time when their release from service conditions is near, and before they are squarely confronted with the problems of civilian readjustment.

The great majority of those interviewed are "normal" persons with rather superficially determined emotional conflicts arising largely out of marital and other familial stresses, inadequate sex education, trying past experiences in the service, and challenges anticipated on return to civil life. In such persons it is common to find undue fatigability, and many other somatic concerns and tension symptoms, anxieties, irritability, and the like. Only a small minority of men interviewed (perhaps 5 percent) have personality problems of such intensity or complexity as to warrant referral to a psychiatric clinic or related facility (if such is available in his home community).[4]

[4] The "Directory of Psychiatric Clinics and Related Facilities," compiled by the National Committee for Mental Hygiene (1944) and the "List of Fellows and Members of the American Psychiatric Association" (1944) were useful in such referrals.

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It appears that the questionnaire often succeeds in helping to prepare a man to understand and accept the general purpose of the interview and to feel comfortable in bringing up for discussion questions of importance in his life. The questionnaire, the health record, and Form Y constitute a time-saving device in the interview situation because they serve to focus attention promptly on pertinent problems. In evaluating the effectiveness of the short mental hygiene interview, our experience has shown that with these aids, despite limited time (usually not more than 10 to 12 minutes for each interview), it is very often possible to obtain the separatee's confidence and to make the interview an experience of practical value to him. The psychiatrist, through his interest in the man, his encouragement of the expression of feelings, his furnishing information and correcting misinformation, often seems to be helpful in bringing a man closer to the satisfactory handling of conflicting needs. It is conceivable that such services occasionally aid men in avoiding more disruptive maladjustments at a later date.

The questionnaire described here has made available a body of data regarding the possible relationship to mental health of (1) certain diverse factors in military experience, such as overseas and combat operations, and length of service; and (2) selected factors involving previous civilian experience, such as rural versus urban background, the occurrence of interstate migration, a man's own evaluation of his emotional life during childhood, and the like. The presentation and evaluation of such data are not within the scope of this article, but it is believed that a study along these lines might be helpful in furthering a better understanding of the emotional problems of servicemen and veterans.




X-RAY TREATMENT OF BLADDER CARCINOMA

Of 68 patients with advanced carcinoma of the bladder treated between 1934 and 1940 with 800-kilovolt roentgen irradiation, 10 are so far clinically well and cystoscopically without evidence of disease. Seven of these are well and have remained well for more than 4 years.

A small carcinoma of a primarily infiltrating type is better handled by surgical excision, if this is feasible. If the lesion is so located that a complete bladder resection is the only surgical procedure possible, interstitial irradication, preferably in the form of implantation of removable radium needles, is probably superior to roentgen therapy, provided the actual size of the tumor is not beyond about 3.5 cm. in diameter.—BUSCHKE, F., and CANTRIL, S. T.: Indications for roentgen therapy of bladder carcinomas; recognition of suitable cases. Surg., Gynec. & Obst. 82: 29–35, January 1946.

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SHIGELLOSIS STUDIES

II. RESISTANCE OF SHIGELLA FLEXNERI II TO THERAPY WITH SULFADIAZINE[1]

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Dysentery and paradysentery bacilli are currently grouped together as the shigella genus. There are three subgroups of shigella which can be differentiated by their ability to ferment sugars. These varieties differ somewhat in their pathogenicity. Of the Shiga group, which ferments neither mannitol nor lactose, Shigella dysenteriae is the most important organism. It produces an exotoxin and gives rise to the most prostrating type of dysentery. The Flexner-Boyd group (*1*) (*2*) ferments mannitol but not lactose and consists of 14 antigenically different strains. The common ones are pathogenic but tend to produce a less severe disease than Shigella dysenteriae. The members of the Sonne-dispar group, which ferment both mannitol and lactose, give rise to various clinical pictures. Sulfonamides are considered to be the most effective specific form of therapy for infections with Flexner-Boyd organisms (*3*).

In the summer of 1945 there was a widespread epidemic of bacillary dysentery due to Shigella flexneri III in San Pedro Bay, Leyte, P. I. During the last week of July the U. S. S. *Oberlin Victory*, an ammunition ship, was engaged in loading operations alongside the U. S. S. *Mississippi* on which there was an acute outbreak caused by Shigella flexneri III. On 27 July several persons in the ship's company of the U. S. S. *Oberlin Victory* noticed malaise, nausea, abdominal cramping, and slight diarrhea. The next day chills, fever, abdominal cramps, tenesmus and diarrhea, with the passage of feculent material, blood, and mucus were experienced. A few of the men

[1] No. 1 in this series "Etiology and Clinical Features" appeared in the April 1946 issue, p. 528.

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were prostrated. By 29 July, 17 men had been admitted to the sick list. Subsequent admissions increased the number stricken to 35. The ship's complement was 104.

One gram of sulfadiazine was given every 6 hours in all clinical cases. This was continued until the symptoms had disappeared and the stools had regained their normal consistency. Two grams were administered daily to the remainder of the crew as a prophylactic measure.

On 8 August and again on 9 August 1945 two of us from the U. S. S. *Benevolence* visited the U. S. S. *Oberlin Victory*, which was at that time anchored at Eniwetok. On 9 August specimens taken from the patients by rectal swab were cultured by us. These patients were ambulatory at that time and had apparently recovered. There were no temperature elevations and the stools were grossly normal. Twenty-three of the specimens yielded a non-motile, gram-negative organism with the cultural characteristics of the shigella.

The source of the outbreak was not determined. Sanitary conditions at San Pedro Bay were described by the crew as unsatisfactory because sewage from a large number of ships was discharged into a comparatively small body of water. Flies were said to have been prevalent in that port. There had been no liberty parties in that area before the outbreak. Although the mess cook was one of the first to be stricken, a careful history revealed no evidence that he had suffered from chronic or relapsing dysentery or from any indefinable digestive disorder. Sanitary conditions aboard the stricken vessel were found to be satisfactory. The galley, refrigerator, scuttlebutts, heads, and living compartments were thoroughly inspected.

CLINICAL FEATURES

The 35 cases of dysentery aboard the U. S. S. *Oberlin Victory* were reviewed clinically by means of the simplified history form devised by the Enteric Pathogen Laboratory at the Naval Medical School (*3*). A thirty-sixth case subsequently developed in a laboratory worker aboard the U. S. S. *Benevolence*. The leading symptoms and findings of the entire group are presented.

After an undetermined incubation period, 35 members of the *Oberlin Victory* crew were seized with symptoms characteristic of bacillary dysentery (see accompanying table). The first 17 patients became ill on the same day, and the others followed rapidly thereafter. The Naval and Merchant Marine personnel affected averaged 21.8 years of age, the youngest being 17, the oldest 43. All had diarrhea varying in severity from 3 to 30 stools per day. The average was 10.8 stools. Bloody stools were reported in 8 cases, representing 22 percent of the

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total. Whereas the unmistakable color of blood may validate the significance of this figure, it is presumed that the incidence of mucus and pus in the stools, as reported by the patients, is too low. Microscopic examination of the feces at the peak of the epidemic would have been helpful in determining the presence of a characteristic cellular exudate.

Clinical features of 36 cases of dysentery

	Number of cases	Percent
Diarrhea	36	100
Under 10 stools daily	21	58
10 stools or over daily	15	42
Abdominal cramps	33	92
Fever	32	89
101° F. or over	23	64
103° F. or over	8	22
Prostration (bed care)	31	86
3 days or more	21	58
10 days or more	5	14
Positive rectal swab cultures (10 days after average onset)	24	67
Nausea	16	44
Vomiting	10	28
Gross blood in stools	8	22
Mucus in stools	8	22
Gross pus in stools	3	8

Fever was present in all but 4 of the cases. Prostration was estimated from the number of days in the sickbay. Only 5 patients were treated on an ambulatory basis. Twenty-one required 3 or more days of bed care, and 5 required 10 or more days of hospitalization. Abdominal cramps were present in all except 3 cases, but the degree of tenesmus was not evaluated. The one patient observed by us during the acute phase of the disease had severe initial coryza. All made a good clinical recovery. Most of those on the *Oberlin Victory* were free from diarrhea at the time the rectal swab cultures were made. The role of sulfadiazine in effecting this outcome appears doubtful in view of the large number of dysentery organisms isolated. Ship movements precluded an adequate follow-up of residual carriers. There was no correlation between the severity of the symptoms and the presence or absence of positive cultures.

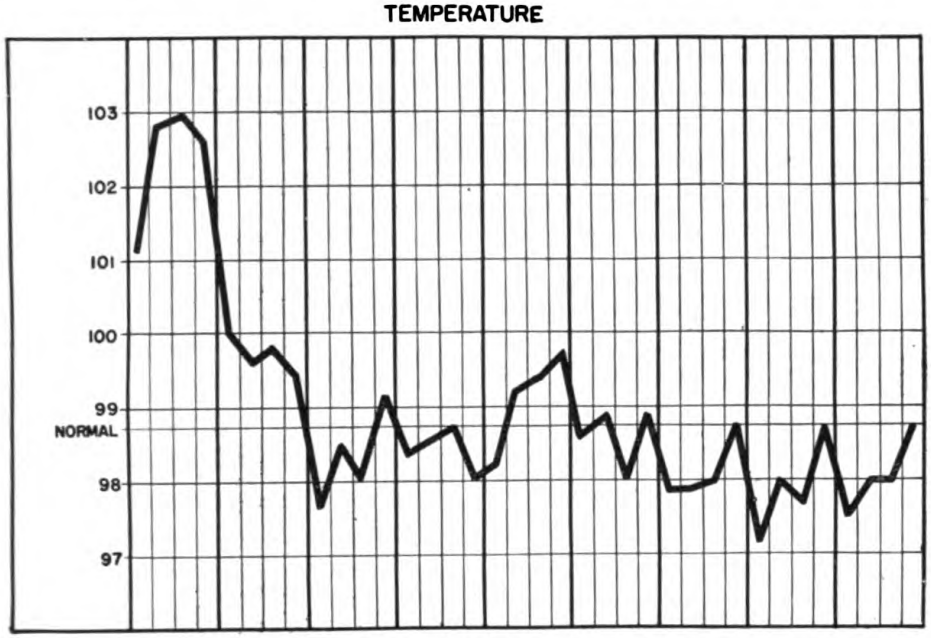
One case of dysentery was observed by us during the stage of acute illness.

Case report.—A hospital corpsman, 24 years old, attached to the U. S. S. *Benevolence*, on 9 August 1945, assisted in making cultures from specimens taken from the members of the crew of the U. S. S. *Oberlin Victory*. During the ensuing 2 weeks he worked in the laboratory subculturing the bacteria and on 20 August he became acutely ill with dysentery.

At the onset he experienced headache, backache, chilly sensations, and severe diarrhea, but no nausea, vomiting, or tenesmus. Subsequently he had abdominal cramps. Because of these symptoms he was admitted to the sick list and isolated on 21 August. At that time his temperature was 101.2° F., the pulse rate 100, and the respirations were 22 per minute. Physical examination revealed coryza

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with moderate congestion of the nasal passages, diffuse injection of the pharynx, and a moderate posterior nasal discharge. Otherwise there were no noteworthy findings.



Fever chart of a case of dysentery caused by Shigella flexneri III. This patient received no specific therapy.

Because of the pronounced coryza, supportive therapy only was given, pending bacteriologic diagnosis. The temperature rose rapidly to 103° F., (see accompanying chart) and descended to normal on the third hospital day. The stools were watery, contained large amounts of mucus, and toward the end of the illness were tinged with blood. Their frequency gradually diminished. A single formed specimen was passed on the sixth hospital day. Blood and urine studies were normal.

This case of laboratory infection was not only culturally identical with the epidemic cases but also had similar clinical features.

Specimens obtained by the rectal swab technic (*4*) from all the affected members of the crew of the U. S. S. *Oberlin Victory* were plated on shigella-salmonella agar, and a stool specimen from the case seen aboard the U. S. S. *Benevolence* was similarly inoculated. Twenty-four of these plates, including the one from the U. S. S. *Benevolence*, yielded colorless colonies of non-motile, gram-negative bacilli. Russell double sugar slants inoculated with these organisms showed in the butt the formation of acid without gas. Subsequent fermentation and serologic tests indicated that the bacilli were Shigella flexneri III.

COMMENT

The ability to culture this organism from 10 to 13 days after the outbreak of symptoms in patients treated with sulfadiazine suggests

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that the strain is sulfa-resistant. Ordinarily it is difficult to obtain a high percentage of positive shigella cultures unless the specimens are plated in the earliest stage of the disease. The immediate planting of rectal swab specimens undoubtedly contributed to the isolation of bacilli from so many of the patients in this series. Nevertheless, had sulfadiazine been therapeutically effective, one would expect a smaller number of isolations. In all probability the self-limited course of the disease was due to the inherent pathogenic properties of the organism rather than to the therapeutic agent employed.

SUMMARY

An outbreak of diarrhea aboard a ship which had called at San Pedro Bay, Leyte, P. I., was studied clinically and bacteriologically. The symptoms were those of a moderately severe, but apparently self-limited bacillary dysentery. Samples of fecal material from all the affected persons were obtained by the rectal swab technic and inoculated onto salmonella-shigella agar. Each of the patients had received 4 grams of sulfadiazine daily during the symptomatic phase of the disease, yet two-thirds of the cases yielded positive cultures.

CONCLUSIONS

1. An outbreak of dysentery due to Shigella flexneri III is described.
2. The symptoms, although moderately severe, appear to have been self-limited.
3. Sulfadiazine in standard dosage was ineffective in eliminating the organisms from the feces.

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FAILURE OF TYPE SPECIFIC STREPTOCOCCUS PYOGENES VACCINE TO PREVENT RESPIRATORY INFECTIONS

EPIDEMIOLOGY UNIT NO. 22[1]

In the summer of 1944 at the Naval Training Center, Farragut, Idaho, Streptococcus pyogenes infections had become epidemic. The majority of such infections were caused by Group A, Types 17 and 19, strains that are sulfadiazine-resistant, and hence they were not affected by sulfadiazine prophylaxis. During this outbreak an attempt was made to control such infections by type specific streptococcal vaccine inactivated by two methods—heat and ultraviolet rays. This is a report of the failure of these vaccines to accomplish the desired result.

In 1943 to 1944, U. S. Naval Medical Research Unit No. 2 (Rockefeller Unit) working at the U. S. Naval Training Center, Bainbridge, Md., found that a heat-killed Type 19 Streptococcus pyogenes vaccine seemed moderately effective in controlling streptococcal respiratory infections. Three companies were treated with the vaccine, three companies were given prophylactic sulfadiazine, and three companies served as controls. There were approximately 400 men in each group. Although sulfadiazine prophylaxis was most effective, there was statistically less respiratory illness in the vaccinated groups than in the controls. This result was not limited to Type 19 infections, but was apparent in other Group A (hemolytic) streptococcal infections. No effect, however, was noted in the carrier rate or in nonstreptococcal infections. In 1944, Levinson et al.[2] reported the successful use in animals of ultraviolet-killed vaccine in certain virus infections and in some bacterial infections.

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[1] The members of Epidemiology Unit No. 22 participating in this work were Commanders Donald C. Young, Burtis B. Breese, Allison F. Errington, and Walter Stoeffler (MC). U. S. N. R.; Ensigns Fred A. Zuelzke (HC), U. S. N.; Leroy V. Grussendorf H(S), U. S. N. R.: and Russell R. Harrison (HC), U. S. N.; Chief Pharmacist Grove G. Wiley, U. S. N.: Chief Pharmacist's Mate Edward L. Warmanen, U. S. N. R.; Pharmacist's Mates, first class, William D. Harrison, Carl G. Johnson, and Peter Packet, U. S. N. R., Pharmacist's Mates, second class, Fred W. Elias, Jack Linder, and Pharmacist's Mate, third class, Herbert Stevenson, U. S. N. R.

[2] LEVINSON, S. O.; MILZER, A.; SHAUGHNESSY, H. J.; NEAL, J. L.; and OPPENHEIMER, F.: Production of potent inactivated vaccines with ultraviolet irradiation; abbreviated preliminary report on sterilization of bacteria and immunization with rabies and St. Louis encephalitis vaccines. J. A. M. A. 125: 531–532, June 24, 1944.

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METHOD

Through the kindness of U. S. Naval Medical Research Unit No. 2, a heat-killed vaccine similar to that used in the Bainbridge study and an ultraviolet-killed vaccine were made available for trial at the Farragut Naval Training Center. Both vaccines were prepared from a sulfadiazine-resistant strain of Streptococcus pyogenes, Type 19, isolated from a case of tonsillitis at Farragut. This vaccine contained 1 billion organisms per cubic centimeter. In addition, a heat-killed vaccine was prepared from both Type 17 and Type 19 containing 0.5 billion organisms per cubic centimeter of each type. The Type 17 strain was also obtained from a patient at Farragut suffering from a streptococcal infection. Like the Type 19 organism, it was also sulfadiazine resistant.

Three experiments were made. In the first, 12 companies which had most recently arrived at the Center were selected. In each company of 100 men, the first man received 3 doses of 0.5 cc. of ultraviolet-killed vaccine; the second man received 3 doses of 0.5 cc. of heat-killed vaccine; and the third man received 3 doses of 0.5 cc. of physiologic saline solution. The inoculations were given (as in the other two experiments) in the course of 1 week, with an interval of 4 days between the first and second doses, and 3 days between the second and third doses.

Using the system inaugurated at Bainbridge, these men were closely followed throughout their training period (approximately 12 weeks) during sick call and in the dispensaries. A large proportion of the men were seen by the epidemiology medical officers and most of the remainder were seen by the dispensary medical officers who cooperated in the study. Practically all patients with respiratory infections had throat exudate cultures made at the time of these infections. The carrier rate in men not suffering from respiratory infections was also followed. In the first few weeks of the study the carrier rate was based on the results of cultures, the material for which was taken on patients seen at sick call with injuries and nonrespiratory illnesses. Thereafter the rate was based on cultures made from throat swabs taken from well men in company groups.

All cultures were taken in broth and transferred to blood plates in the laboratory. Positive cultures for Streptococcus pyogenes were sent to the National Naval Medical Center for typing and grouping. However because of the work load on that laboratory, less than half of the positive cultures could be typed. The proportion of cultures typed was larger in the first 6 weeks than in the last 6 weeks of the study.

The second study was limited to 1 camp (Camp Peterson), from which the recruits came into the Center subsequent to those of the 12

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companies observed in the first experiment. In this camp the odd-numbered companies received 3 doses of 0.5 cc. each (total 1.5 billion organisms) of Type 19 heat-killed vaccine, while the even-numbered companies (alternate) received no vaccine. The vaccine program was completed by 13 November and morbidity rates compared through the 8-week period from 13 November to 8 January. The attack rate for respiratory infections was judged in the control and vaccinated groups on the basis of the hospital and dispensary admissions as logged in the morning report of sick. Only admissions for scarlet fever, tonsillitis-pharyngitis and catarrhal fever were compared; other illnesses and sick-call visits were not included in the comparison of morbidity rates. Cultures were made for practically all patients admitted with any type of respiratory infection, and a representative sample of the cultures was typed.

The third experiment was made in the Service School group of recuits. A combination of Type 17 and Type 19 heat-killed vaccine was given to men in every other company in each school, the alternate companies received no vaccine. The three doses were completed in the Service Schools by 15 November, and the illness rates were followed from 18 November through 31 December, a period of 44 days. Results were based on observations on the admissions to the dispensary and hospital, but bacteriologic confirmation of diagnoses was limited and no cultures were typed.

Reactions to the vaccine were, in the single type vaccine, on the whole, mild and local in nature. In the combination vaccine, however, at least 50 percent of the men had some reaction, either local or general. Some of the general reactions were severe, with fever as high as 105° F., general malaise, headache, abdominal pain, joint pains, and nausea and vomiting. They were of short duration, lasting less than 48 hours. The severity of these reactions to the initial dose of 0.5 cc. forced a reduction of the subsequent doses to 0.3 cc. and 0.4 cc. respectively, giving a total final dose in this group of 1.2 billion organisms.

RESULTS OF EXPERIMENT NO. 1

From this group all recruits were excluded who did not receive the full course of vaccine. The results were analyzed on two bases, on that of the individual recruit (the number who had tonsillitis) and on that of illnesses (the number of cases of tonsillitis). Since a number of men had had more than one illness and most were cultured more than once, the second group is larger than the first. However, in the case of illness, every effort was made to exclude repeat observations on the same illness.

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In table 1 the distribution of illness in the individual recruits is given in each of the three groups. It will be noted that no essential difference exists between them.

TABLE 1.—*Distribution of respiratory infections among three vaccinated groups of recruits*

	Ultraviolet vaccine		Heat-killed vaccine		Physiologic saline solution	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
No attacks	182	47.8	157	42.7	174	46.7
One respiratory infection	135	35.4	150	40.8	129	34.6
Two respiratory infections	47	12.3	45	12.2	61	16.3
Three or more respiratory infections	17	4.5	16	4.3	9	2.4
Totals	381	100.0	368	100.0	373	100.0

Of those who develop respiratory infections, the distribution of positive cultures in the three groups was also practically the same (table 2).

TABLE 2.—*Results of throat cultures for Streptococcus pyogenes in respiratory infections in three vaccinated groups*

	Ultra violet vaccine		Heat-killed vaccine		Physiologic saline solution	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Not cultured	12	6.0	7	3.2	7	3.5
Never positive	59	29.6	59	28.0	53	26.6
Positive at least once	128	64.4	145	68.8	139	69.9
Totals	199	100.0	211	100.0	199	100.0

Of those recruits who had positive cultures, approximately the same proportion of strains from each vaccine group were typed, and the percentage due to Type 19 was about equal (table 3).

TABLE 3.—*Results of typing of Streptococcus pyogenes found in respiratory infections in three vaccinated groups*

	Ultraviolet vaccine		Heat-killed vaccine		Physiologic saline solution	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Type 19	17	27.9	20	25.6	22	27.5
Other types	44	72.1	58	74.4	58	72.5
Totals	61	100.0	78	100.0	80	100.0

In the group of men who suffered no respiratory infections during the period of the study no difference could be observed between the three groups in the percentage of positive cultures (table 4).

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TABLE 4.—*Results of cultures in relation to type of vaccine used in men who had no respiratory infections*

	Ultraviolet vaccine		Heat-killed vaccine		Physiologic saline solution	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Not cultured	0	0	1	0.6	12	6.9
Cultured but never positive	48	26.4	53	33.8	57	32.8
Positive at least once	134	73.6	103	65.6	105	60.3
Totals	182	100.0	157	100.0	174	100.0

Considering both the group who suffered from respiratory infections and those who did not experience any respiratory illness, the three groups receiving vaccine showed remarkable similarity in the distribution of positive cultures (table 5), and in the distribution of Type 19 infections (table 6).

TABLE 5.—*Distribution of cultures of Streptococcus pyogenes in relation to type of vaccine in recruits with and without respiratory infection*

	Ultraviolet vaccine		Heat-killed vaccine		Physiologic saline solution	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Not cultured	12	3.1	8	2.2	19	5.1
Never positive	107	28.1	112	30.4	110	29.5
Positive at least once	262	68.8	248	67.4	244	65.4
Totals	381	100.0	368	100.0	373	100.0

TABLE 6.—*Distribution of types of Streptococcus pyogenes in relation to type of vaccine in recruits with and without respiratory infection*

	Ultraviolet vaccine		Heat-killed vaccine		Physiologic saline solution	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Types other than Type 19	66	71.7	76	76.8	77	77.0
Type 19	26	28.3	23	23.2	23	23.0
Totals	92	100.0	99	100.0	100	100.0

Assuming that the typed cultures were representative of all the positive cultures, 18 percent of the recruits in the ultraviolet-killed vaccine group, 16 percent of those in the heat-killed vaccine group, and 16 percent in the control group had cultures which were positive for Type 19 at some time in the course of the 12-week training period.

When the individual illnesses are considered by diagnosis, it is apparent that the distribution of these infections in each series is approximately the same (table 7).

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TABLE 7.—*Comparison of number and percentage of cases positive for Streptococcus pyogenes in each of three vaccinated groups*

(No distinction made between admitted and nonadmitted cases)

	Ultraviolet vaccine		Heat-killed vaccine		Physiologic saline solution	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Scarlet fever	37	85.3	36	91.0	37	88.9
Tonsillitis, pharyngitis	151	56.2	159	64.9	142	63.2
Catarrhal fever	38	53.0	36	50.0	37	56.3
Cold, bronchitis, etc	36	29.4	31	23.3	38	24.3
Otitis media, sinusitis, etc	13	55.6	17	31.2	18	40.0
Rheumatic fever*	8	40.0	13	20.0	7	50.0
Totals	283	55.8	292	58.2	279	59.4

*Includes arthritis and myositis, acute.

When the observations are limited to cases admitted to the hospital or dispensaries, the same similarity is found (table 8).

The carrier rate and percentage of positive cultures in respiratory infections when plotted by 2-week periods shows no difference between the three groups (figs. 1 and 2).

TABLE 8.—*Distribution of admitted cases and percentage positive for Streptococcus pyogenes in each of three vaccinated groups*

	Ultraviolet vaccine		Heat-killed vaccine		Physiologic saline solution	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Scarlet fever	37	85.3	36	91.0	37	88.9
Tonsillitis, pharyngitis	73	76.5	86	77.1	90	79.1
Catarrhal fever	25	63.7	28	58.4	24	73.7
Cold, bronchitis, etc	5	----------	0	----------	1	----------
Otitis media, sinusitis, etc	4	----------	10	----------	12	----------
Rheumatic fever*	5	----------	6	----------	3	----------
Totals	149	75.6	166	75.8	167	80.2

*Includes arthritis and myositis, acute.

TABLE 9.—*Percentage of type 19 Streptococcus pyogenes in cultures taken in three different vaccinated groups*

	Type 19		Type 19		Type 19	
	Number typed	Percent	Number typed	Percent	Number typed	Percent
Scarlet fever	16	43.8	9	33.0	18	50.0
Tonsillitis, pharyngitis	37	18.9	60	25.0	48	25.0
All other respiratory infections	17	17.6	13	23.1	14	7.1
No respiratory infection	47	19.1	30	20.0	31	3.2
Totals	117	22.4	112	24.1	111	20.7

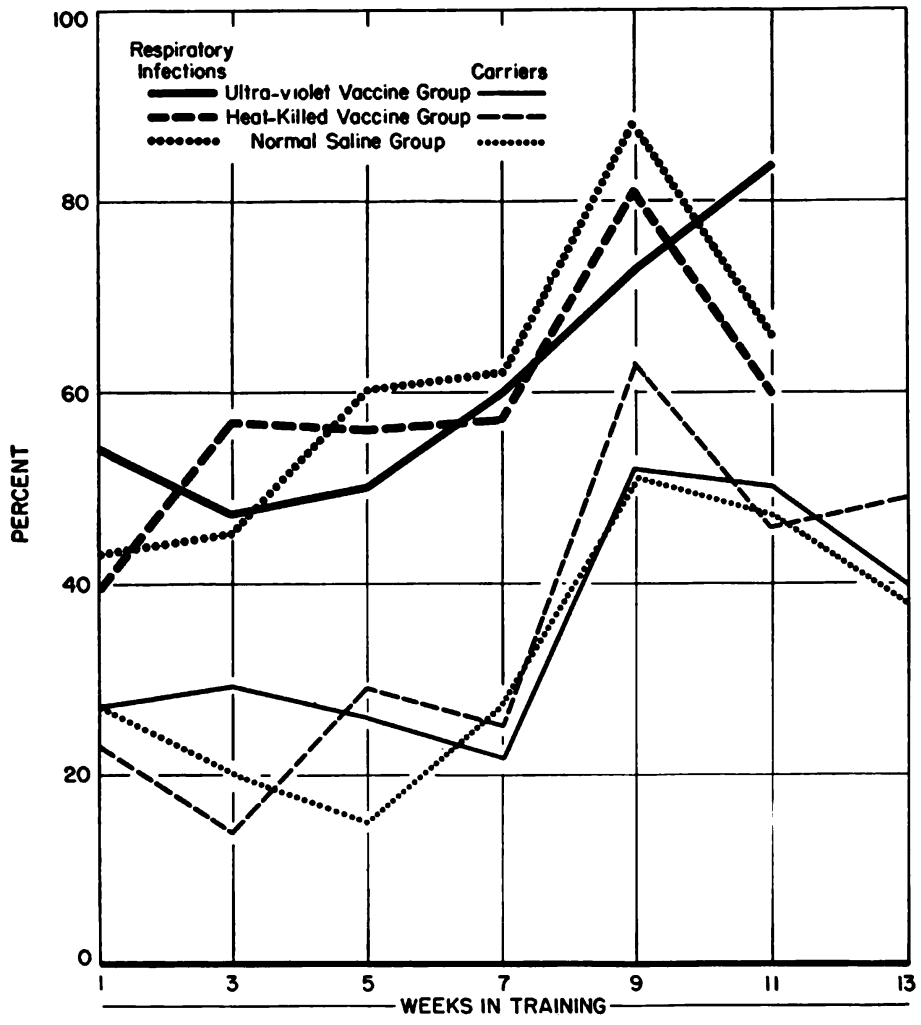
The number of positive cultures typed in each diagnostic category was small but showed no difference between the three groups in the percentage of Type 19 infection (table 9).

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Lastly, there seemed to be no difference in the general pattern of the attack rates in three groups to time in camp (fig 2). These rates are based on the man-exposure days in each group for each period. Because of losses due to illness and other factors in the recruits in the original groups, there was a continuous decrease in population which was taken into account in calculating these results. Incidentally it was found that the loss of men from all factors was about equal throughout the training period in each of the three series.

FIGURE I

PERCENT OF CULTURES POSITIVE FOR STREPTOCOCCUS PYOGENES IN RECRUITS WITH RESPIRATORY INFECTIONS AND IN CARRIERS BY TIME IN TRAINING TO TYPE OF VACCINE USED



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RESULTS OF EXPERIMENT NO. 2 (CAMP PETERSON)

As seen in table 10, there was no significant difference in morbidity between the vaccinated and control groups in the three major illness groups.

Similarly, there was no difference between the attack rate of patients with respiratory infections admitted with positive cultures, or the heaviness of growth found on these plates of cultures made for the treated and untreated recruits (table 11).

Although only a portion of the cultures were typed, this typing was done on random samples from both groups. Thirty Type 19 cultures were found in men from the vaccinated group and 31 in the non-vaccinated group.

TABLE 10.—*Comparison of illness in vaccinated and nonvaccinated companies (Camp Peterson) 13 November 1944 to 7 January 1945*

Average population	Vaccinated (1,452)		Vaccinated (1,542)	
	Cases	Rate*	Cases	Rate*
Scarlet fever	25	112	17	72
Tonsillitis, pharyngitis	95	426	119	503
Catarrhal fever	49	220	51	216
Totals	169	758	187	791

*Per 1,000 per year.

TABLE 11.—*Results of cultures for Streptococcus pyogenes in patients ill with respiratory infections of all types (Camp Peterson) 13 November to 7 January 1945*

Average population	Vaccinated (1,452)		Vaccinated (1,542)	
	Number	Rate*	Number	Rate*
Negative cultures	57	250	64	271
1- and 2-plus positive	21	92	22	93
3- and 4-plus positive	121	529	124	524
Totals	199	871	210	888

*Per 1,000 per year.

RESULTS OF EXPERIMENT NO. 3

In the Service Schools no demonstrable difference between the treated and untreated groups was observed in the attack rates (table 12).

Sixty-five percent of the throat cultures obtained from patients with respiratory infections were positive for Streptococcus pyogenes in the non-vaccinated group, and 57 percent in the vaccinated group—an insignificant difference.

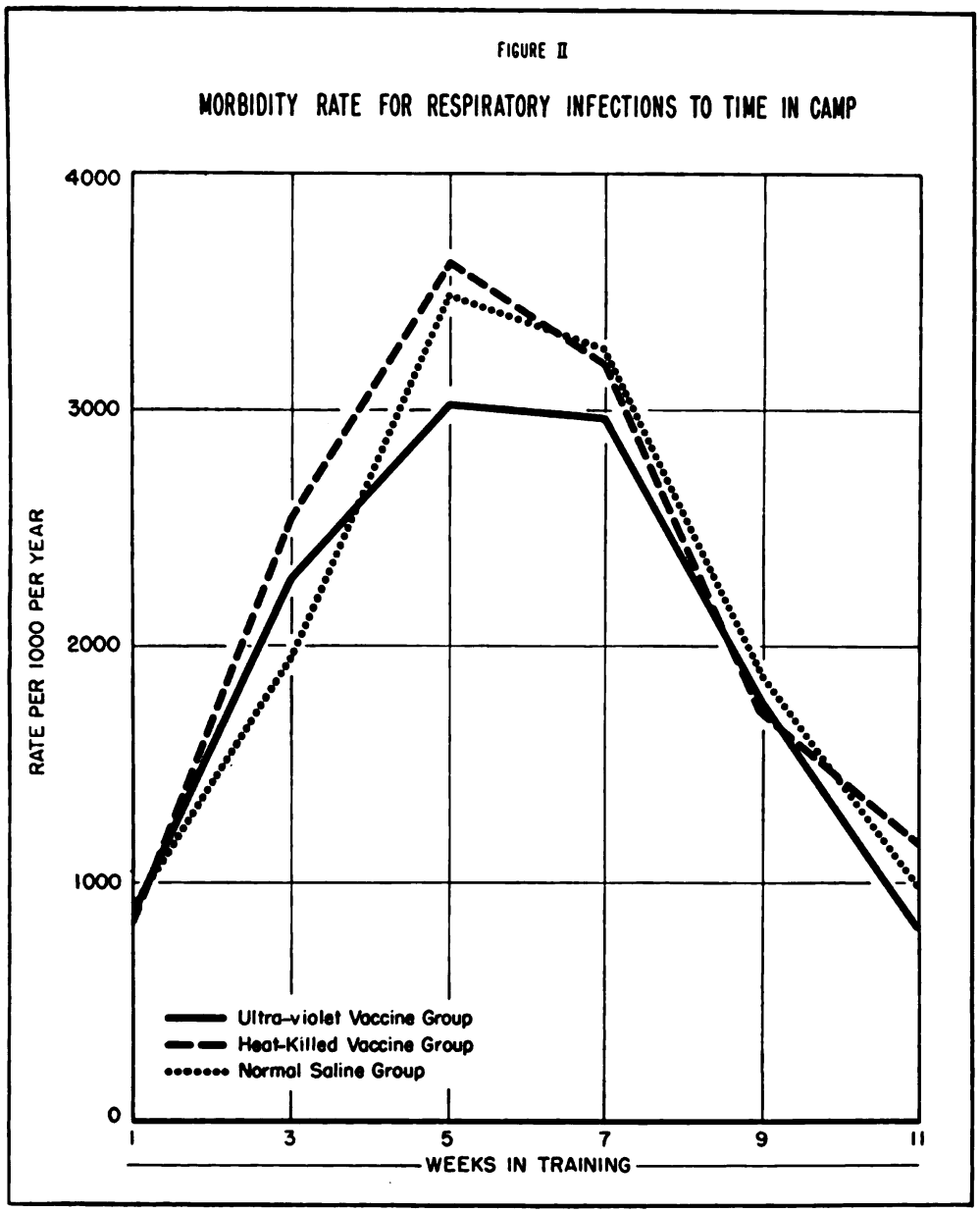
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TABLE 12.—*Comparison of morbidity in vaccinated and nonvaccinated Service School personnel, 13 November to 31 December 1945*

Average population	Vaccinated (1,393)		Not vaccinated (1,528)	
	Cases	Rate*	Cases	Rate*
Scarlet fever	34	202	26	141
Tonsillitis, pharyngitis	33	197	43	233
Catarrhal fever	14	83	16	87
Other respiratory infections	8	47	15	81
Totals	89	529	100	542

*Per 1,000 per year.

FIGURE II



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SUMMARY AND CONCLUSIONS

An attempt was made to prevent Streptococcus pyogenes infections in three different experiments at the Farragut Naval Training Center by the use of type specific vaccine. Type 19 heat-killed vaccine, Type 19 ultraviolet killed vaccine, and a combined Type 17 and Type 19 heat-killed vaccine were used.

No reduction in total respiratory illness, or Streptococcus pyogenes illness was noted. Furthermore Type 19 infections occurred as frequently in the vaccinated group as in the controls. No typing data was obtained on the group treated with the combined Type 17 and Type 19 vaccine.

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FACTORS IN ULCER FORMATION

Clinical studies and impressions appear to indicate that the pituitary-thyroid-gonad mechanism plays a role in human peptic ulcer. It is well known that peptic ulcer is comparatively rare in women, but when it does occur, it is ameliorated by pregnancy and aggravated by the menopause. Also, women with ulcer show a high incidence of endocrinopathies. While ulcer in the adult is approximately 5 to 10 times as frequent in men as it is in women, in children before puberty its occurrence is equal in both sexes though rare. Of interest also is the fact that extracts prepared from urine of both pregnant and normal women have a greater prophylactic, therapeutic and "immunizing" effect on the experimental Mann-Williamson ulcer in dogs, than extracts of urine from normal men.

It is therefore probable that in the female the monthly reproductive cycle and the increased glandular function during active sex life and pregnancies (i. e., the chemical interplay between the pituitary and the ovaries throughout the active menstrual life of the female), augment the production of ulcer "protective factors" and thus serve to prevent or benefit "peptic" ulcer. The absence of these in the male could result in the lesser protection against ulcer. Abnormalities in the glandular function in both the male and the female may affect the protective factors and be responsible for ulcer formation.—KAULBERSZ, J.; PATTERSON, T. L.; SANDWEISS, D. J.; and SALTZSTEIN, H. C.: Relation of endocrine glands to gastric secretory depressant in urine. Science 102: 530–531, November 23, 1945.

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TRAUMATIC RUPTURE OF ADDUCTOR MUSCLES OF THE THIGH[1]

GEORGE CRILE, JR.
Commander (MC) U. S. N. R.

In the past year three so-called "hernias" of the adductor muscles of the thigh have been seen at the U. S. Naval Hospital, San Diego. Observations on these cases have indicated that these deformities are not true hernias and cannot be corrected by repair of the fascia.

A muscle hernia retracts when the muscle is tensed, and bulges when the muscle is relaxed. This test affords a certain method of differentiating the muscle hernias of the lower leg from varicose veins. When the examiner holds the toe of the foot down and tells the patient to raise his toe, the anterior tibial muscles are tensed and the hernia disappears. The same thing is true of muscle hernias elsewhere. But in the so-called adductor muscle hernia the opposite is true. The bulge is not obvious when the muscle is relaxed and appears only when the adductor muscles of the thigh are tensed.

Hernias of the muscles of the lower leg occur as a result of a congenital defect in the fascia at the point where the cutaneous nerves penetrate. They tend to be multiple, and a convincing history of trauma is lacking. Hernias of the quadriceps groups occur following removal of a piece of fascia for transplantation or following a laceration. In both cases a definite defect in the fascia covering the muscle is demonstrable and explicable. In the case of the so-called adductor muscle hernia no defect in the fascia is demonstrable and the hernia is usually caused by a heavy blow or sudden strain.

The so-called adductor muscle hernia is not a hernia at all, but is a ruptured muscle. Trauma causes a rupture of the belly of one or more of the muscles of the adductor group. The ends of these muscles retract. The upper end of the muscle retains its innervation and continues to function, but it is torn loose from its insertion and it therefore contracts itself into a thick mass on the upper inner aspect of the thigh. This mass disappears when the muscle is relaxed and reappears when it is contracted. Pain and weakness of the affected thigh are common complaints.

[1] Received for publication 14 May 1945.

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There are few references in the literature to ruptures of the adductor muscles of the thigh. No references to this condition could be found in the American literature.

McWilliams (*1*) in 1901 reported operating on a "hernia" of the adductor longus muscle. His two patients had developed sudden "herniation" of the adductor longus muscle when the leg was suddenly and strongly adducted during a game of bowls. The pathosis was interpreted as a rupture of the fascia overlying the muscle.

In the German literature Racz (*2*) reported hernia of the adductor longus muscle as a disease peculiar to horseback riders. (One of our cases occurred while the patient was riding a bucking horse.)

A few authors have reported these cases as rupture of the adductor longus muscle (*3*) (*4*) (*5*) (*6*). Most of these reports mention only one or two cases. The lesion is apparently not only rare but also is seldom interpreted correctly.

Two of the three patients in this series, with ruptured adductor muscles, had been operated upon previously with the diagnosis of hernia, adductor muscle of the thigh. In one case a meticulous repair of the fascia with fine steel wire had been done. In neither case did the patient notice any appreciable difference in the size of the mass before and after the operation, and at the time of his entry to the hospital each patient had a large persistent mass.

In the first case no further operation was performed. In the other, secondary operation was done under local anesthesia by Captain H. L. Pugh (MC) U. S. N. The fascia of the adductor region was found to be thin (as is normally the case) but there was no definite defect in the fascia. When the patient was asked to contract the adductor muscle, the mass of muscle would bulge up into the wound, expanding the thin overlying fascia as it did so. In this case the portion of the muscle which protruded was simply excised and the wound closed. The bulge was less than before, but the patient, who had no desire to remain in the service, complained of continued weakness in the thigh and was surveyed from the service.

In the third case no previous operation had been performed and it was possible to demonstrate clearly the true nature of the lesion. The injury had occurred while the patient was playing football. He found after several months at sea that he could not go up and down ladders and work on a rolling ship without experiencing discomfort (fig. 1).

A long incision was made over the adductor muscles and the sheath of the muscle was opened. The upper third of the adductor muscle was found lying in a compartment lined by a glistening, bursa-like membrane. This compartment was about 2 inches longer than the muscle, which had obviously been completely severed. In the cavity

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with the muscle was a tiny "joint mouse" about 0.5 cm. in diameter, smooth, hyalinized and spherical. It was clear that the muscle would have no alternative but to contract upward into a compact knot, for there was no fixation of its distal end within the sheath.



1. (A) Patient standing with adductor muscles relaxed. (B) Patient standing with adductor muscles contracted.

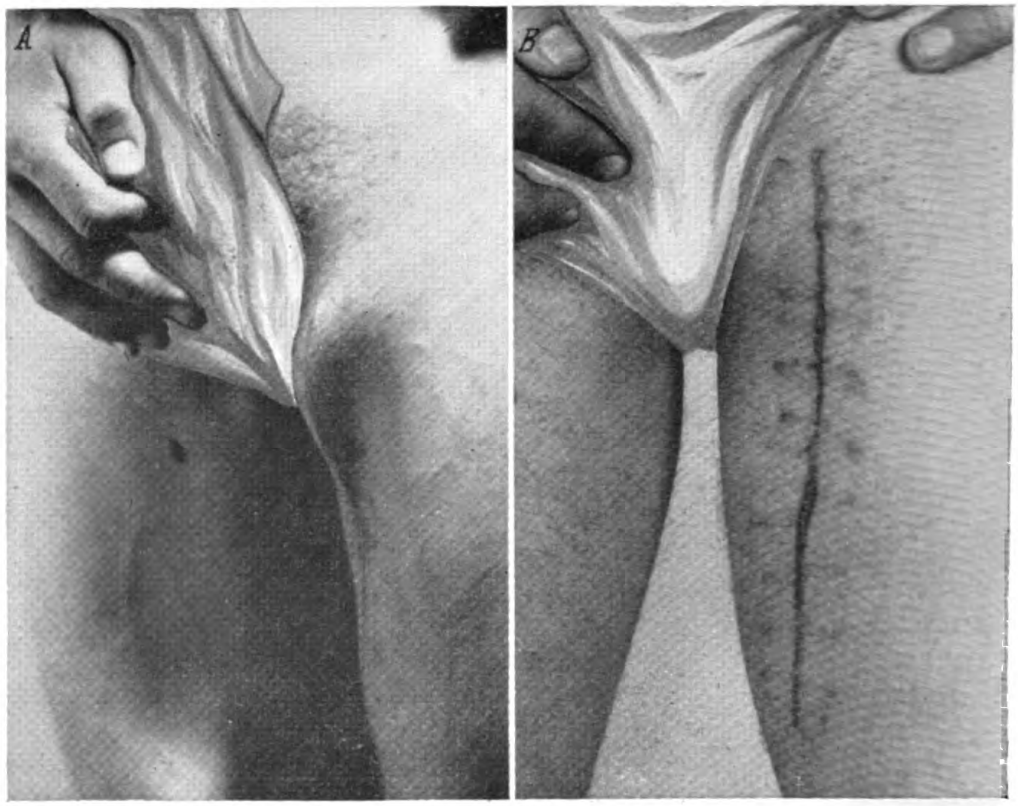
Distal to the muscle, the compartment in which it lay became stenosed, then completely obliterated by fibrosis. An attempt was made to find the distal end of the muscle, but whether this was obliterated by trauma, atrophied by damage to its nerve and blood supply, or retracted out of the field, it could not be found.

The proximal end of the muscle was then pulled down as far as it would come, and the scar tissue at its tip was sutured securely to the fibrosed sheath with No. 32 steel wire. The muscle did not stretch easily, and since it still seemed to be over-contracted and hence thicker than normal, about one-third of its thickness was excised from its anterior portion. The fascia was sutured and wound closed.

Two months after this operation, the patient still complained of weakness of the thigh and examination showed that the bulge had recurred, although it was not so large as before (fig. 2A). A second operation was then performed and it was found that the muscle had

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again retracted into a thick mass in the upper thigh. At this operation the entire adductor muscle was excised (fig. 2B). Three months after operation the thigh is still weak and it has been necessary to survey the patient to limited duty.



2. (A) Recurrence of bulging muscle after attempt at reconstruction of the adductor muscle. (B) End result following excision of adductor muscle.

It is clear from the pathosis found in this case that attempts to correct the deformity of a ruptured adductor muscle should be directed toward fixation of the distal end of the muscle or excision of the muscle tissue rather than toward repair of a supposed defect in the fascia. If the thin, inadequate fascia of this region is sutured over the strong, contractile belly of the muscle, it will merely be stretched or broken at the first contraction.

The ideal treatment would be early diagnosis and operation, before retraction, atrophy, and fibrosis had rendered it impossible to find the distal end and unite it to the proximal end. In later cases it would appear that satisfactory results cannot be obtained by attempts to repair the muscle or fix the proximal end of the muscle to the fascia of the thigh. After excision of the entire muscle, the patient stated that he felt neither better nor worse than before the first op-

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eration. It is questionable, therefore, even if the deformity can be corrected by surgery, whether any type of surgery is of symptomatic benefit in long-standing cases.

SUMMARY

1. The so-called "adductor muscle hernia" is in reality a traumatic rupture of the adductor muscles of the thigh.

2. Correction of this deformity cannot be accomplished by repair of a supposed defect in the fascia.

3. In early cases it is possible that good results could be obtained by repair of the ruptured muscle, but in late cases atrophy, contraction, and fibrosis make it impossible to effect a satisfactory repair.

4. Conservative treatment and reassurance is recommended for patients with ruptured adductor muscles. If the presence of the mass is of cosmetic importance, it can be excised, but the symptoms may not be relieved.

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INFECTIVE HEPATITIS TRANSMISSION

Twenty-four icteric and subicteric cases of infective hepatitis have developed after the oral ingestion of feces or of urine from spontaneous cases of infective hepatitis.

Feces filtered through a Seitz filter proved infective in one experiment. Subicteric cases only have resulted from the oral ingestion of feces or of urine from experimentally produced infections. There is suggestive evidence that concurrent injections of neoarsphenamine increase the liability to positive results.—FINDLEY, G. M., and WILLCOX, R. R.: Infective hepatitis. Lancet 2: 594–597, November 10, 1945.

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TRAUMATIC OSSIFYING MYOSITIS

CAMPBELL HOWARD
Lieutenant Commander (MC) U. S. N. R., Ret.

Traumatic ossifying myositis is a condition in which soft tissue calcification develops following injury. This has also been termed myositis ossificans, ossifying hematoma, or calcified hematoma. The calcification usually develops in from 10 days to 2 weeks following an injury. There is deposition of bone in muscle with a low-grade inflammatory process. The inflammatory process is a degenerative condition and is aseptic. It is due to the injury and to the tissue reaction from a variable amount of soft-tissue hemorrhage. Degenerative changes accompany the absorption of the soft-tissue clot. The osteoblasts appear to arise from injury to the periosteum. Irregular calcification or ossification spreads out in the soft tissue, following the course of the hemorrhage. Two types are described roentgenographically. In one the calcification has a striated appearance, following along the fibers of the muscle in a feathery pattern. In the other type the blood clot undergoes ossification, with a very irregular shape and variable density, spreading out from the periosteum in a lacy pattern.

Various theories have been advanced to explain the development of these localized bone growths. In the series of cases reported here these areas are all in contact with the bone. This would favor the theory of a periosteal injury with escape of osteogenic cells from the periosteum. Inasmuch as every injury is accompanied by some hemorrhage, and as only a comparatively small number of injuries cause these calcified growths, there must be some individual peculiarity, which has not yet been determined, to explain the specific deposit of calcium or bone in the soft tissue. If this were not so, every fracture would show soft-tissue ossification. This individual pecularity does not appear to be due to calcium or phosphorus metabolism, since the blood content of these substances was normal in the cases reported here. This has also been reported by other observers. No cases of parathyroid disease have been found to be associated with this condition. Abnormal calcification of the costal cartilages and the formation of gallstones or kidney stones may be due to the same individual idiosyncrasy.

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The cases here reported were the result of football and soccer injuries among the cadets taking preflight training at the U. S. Navy Pre-Flight School, Chapel Hill, N. C. during the fall of 1944. There were approximately 1,500 cadets in training at this time. Each battalion competed with the others in intramural games. Each cadet was required to have 2 weeks of football. A football squad of 30 or 40 men was selected which competed with the 5 other battalions in these intramural games. There was also a varsity football squad of about one hundred men.

Four cases of myositis ossificans were found following football injuries and one case following an injury incurred while playing soccer. If the same number of such cases were found proportionately among those participating in football throughout the nation, there should be a much larger number of such cases than have been reported. It might be assumed, therefore that the cases seen here are out of proportion to those developing throughout the country, or that many cases have gone unrecognized. Certainly no athletic program can go through an entire season without the participants sustaining a number of injuries which have been commonly called "Charley horse." If these injuries clear up promptly nothing further need be done, but the question arises as to whether those cases that do not subside get sufficient recognition and attention from the coaches and trainers.

The Pre-Flight School has a medical officer who is constantly in attendance at all sports activities. He checks carefully all such injuries and this is probably much more carefully done than in civilian activities. Pack and Braund (*1*) state that the incidence of these cases is undoubtedly higher than has been reported, because often this condition is discovered incidentally after having been present for many years.

This ossification may be found in any of the muscles of the body, but is especially common in the brachialis anticus muscle of the arm and the quadriceps extensor muscles of the thigh. Two of the cases observed here were in the arm and three were in the thigh. The ossification was much more extensive in the leg injuries in these cases than in the arm.

Therapy for these cases consisted in prompt application of an ice pack, which served to check the hemorrhage and extravasation of blood into the soft tissues. Then a roentgenograph was taken to rule out fracture. On the following day a course of heat treatment was begun, with a 15-minute immersion in the whirlpool bath, followed by a short-wave treatment with the inductotherm. These treatments were given twice daily for the first week, which usually sufficed to fit the player to return to the game. If, however, the mass did not absorb within 10 days or 2 weeks, a second x-ray examination usually

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revealed some soft-tissue calcification. Heat therapy was continued when this condition was found, and serial x-ray films were taken to check on the progress of ossification. These serial films showed a progressive increase in density of the calcification and a gradual reduction in size.

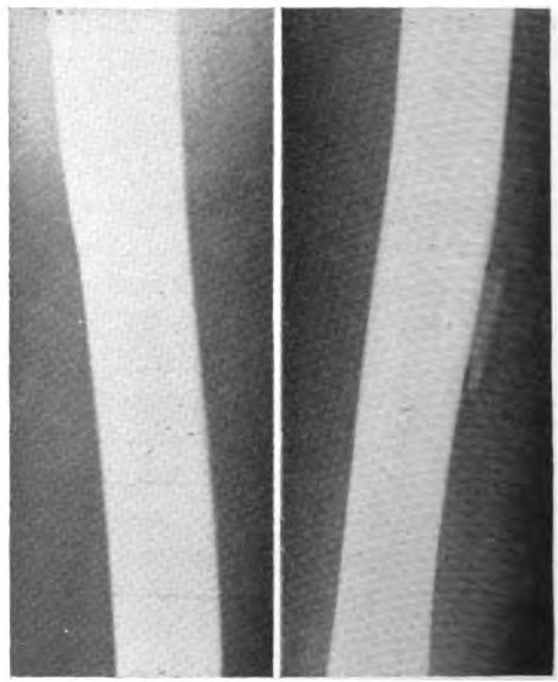
Other therapeutic means were not tried, except for surgery in one case. It is believed that x-ray therapy might be beneficial in these cases, but this was not available. The rationale for x-ray treatment is based on experiences with such therapy in bursitis, where similar calcification has been observed to absorb completely.

In this series, two cases were followed up for 6 months. The other three cases could be followed only for 6 or 8 weeks because the patients were transferred to other stations on the completion of their course.

The accompanying illustrations show the size and extent of the calcification and the relative rate of the absorption. None of these cases showed a complete disappearance of the ossification, although such absorption is possible and has been reported.

CASE REPORTS

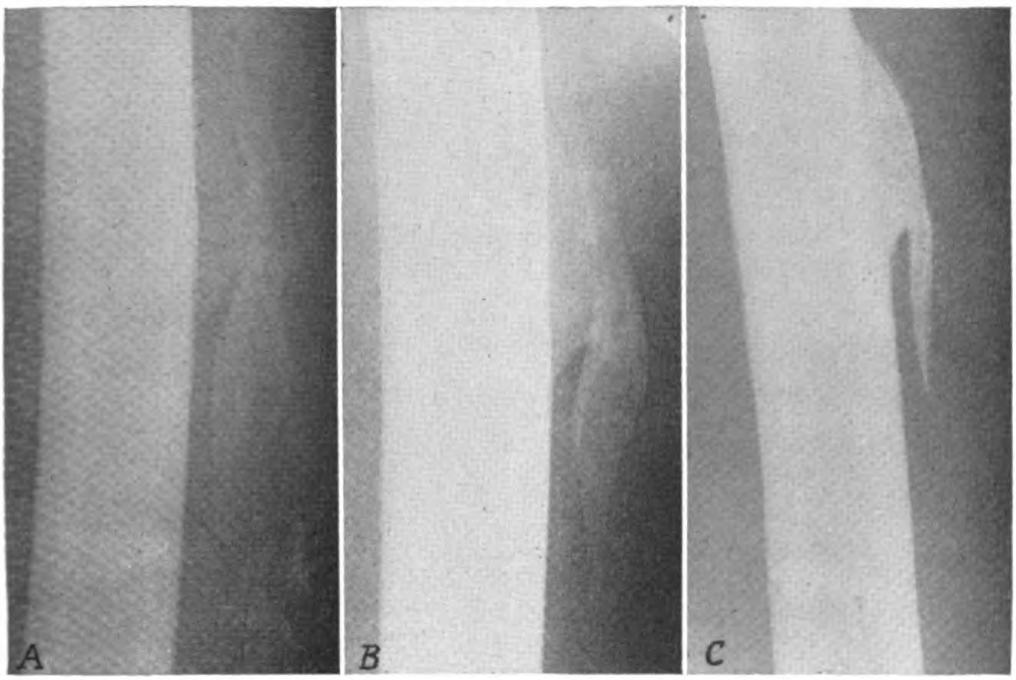
Case 1.—This cadet injured an arm on 9 October 1944 while playing football. He neglected to report for the usual treatment and several days later he felt a definite lump in the arm. Short wave treatments were given and an x-ray taken a few weeks later showed beginning ossification. This case was followed for 6 weeks at which time there was a moderate reduction in the size of the mass (fig. 1). At this time the man was shipped out.



1. Case 1 at time of original injury to the arm and 4 weeks later (4 December 1944).

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Case 2.—This patient was followed for 6 months. He was first injured early in September while playing soccer, and he received a second blow in the same location the following week. He experienced severe pain, especially after the second accident, and could not bend his leg for a long time. He received heat treatments more or less continuously. The original roentgenograph showed an area of apparent ossification 6 inches in length in front of the thigh. The subsequent series of films showed a gradual reduction to less than one-third the original size, with an increase in density of the calcification (fig. 2).



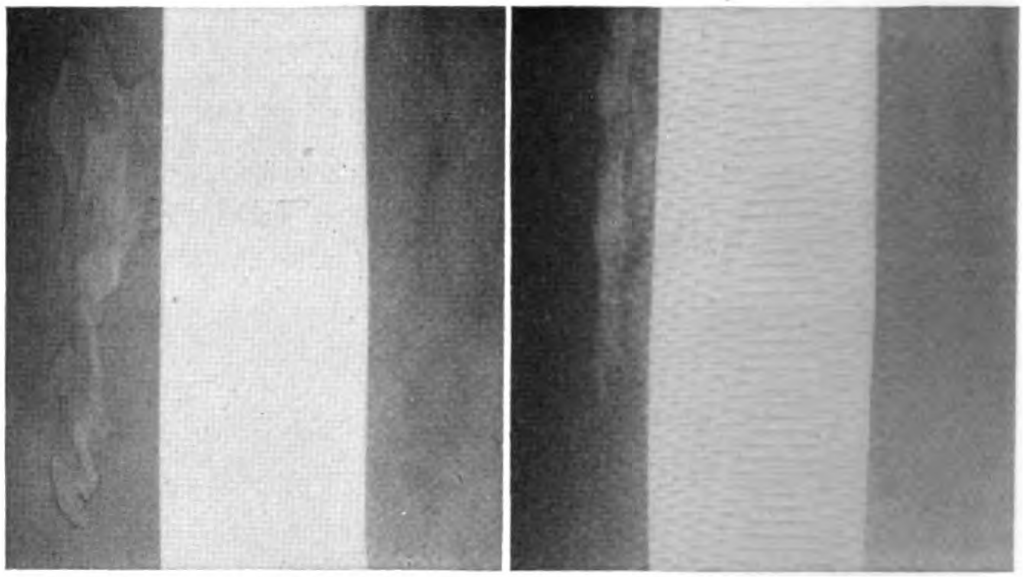
2. Case 2. **(A)** 1 month after injury, **(B)** 3 months, **(C)** 5 months.

Case 3.—This man sustained repeated contusions of the right thigh during the football season. He was first seen on 16 October 1944 and his last examination was on 1 December 1944. During this time he continued to play football despite the injury. There was a moderate reduction in the size of the ossification on the last film before he was transferred (fig. 3).

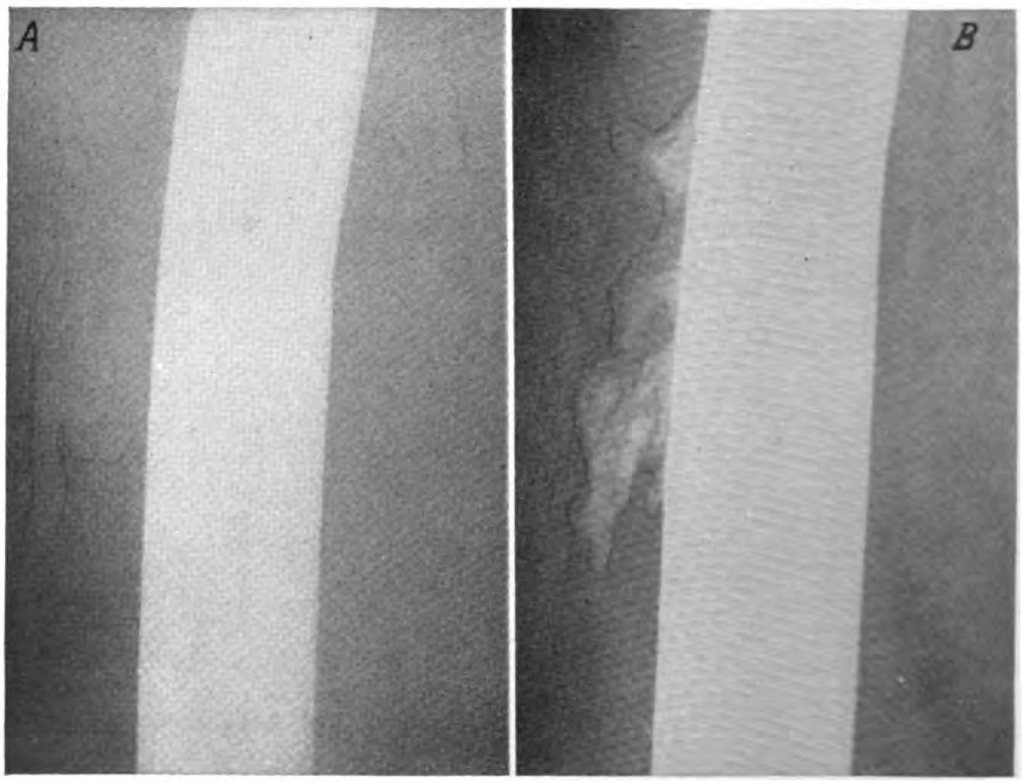
Case 4.—Another cadet was struck on the thigh by his opposing player while playing football on 13 August 1944. He was treated with ice packs and pressure bandages, followed by daily applications of heat. Two weeks later he noted a well defined, hard lump in the thigh which was tender and seemed to be fixed to the bone. The X-ray showed extensive ossification. He was treated daily with heat until 2 October when he was operated upon and a large mass attached to the bone was removed. This was 8 cm. in length.

A roentgenograph taken 2 weeks after the operation showed as much ossification in the soft tissue as was originally found prior to operation. This showed an unsuccessful result from surgery and it is believed that the operation was performed too soon after the injury, before the condition had been completely organized (fig. 4).

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3. Case 3 taken 1 and 2 months after injury.

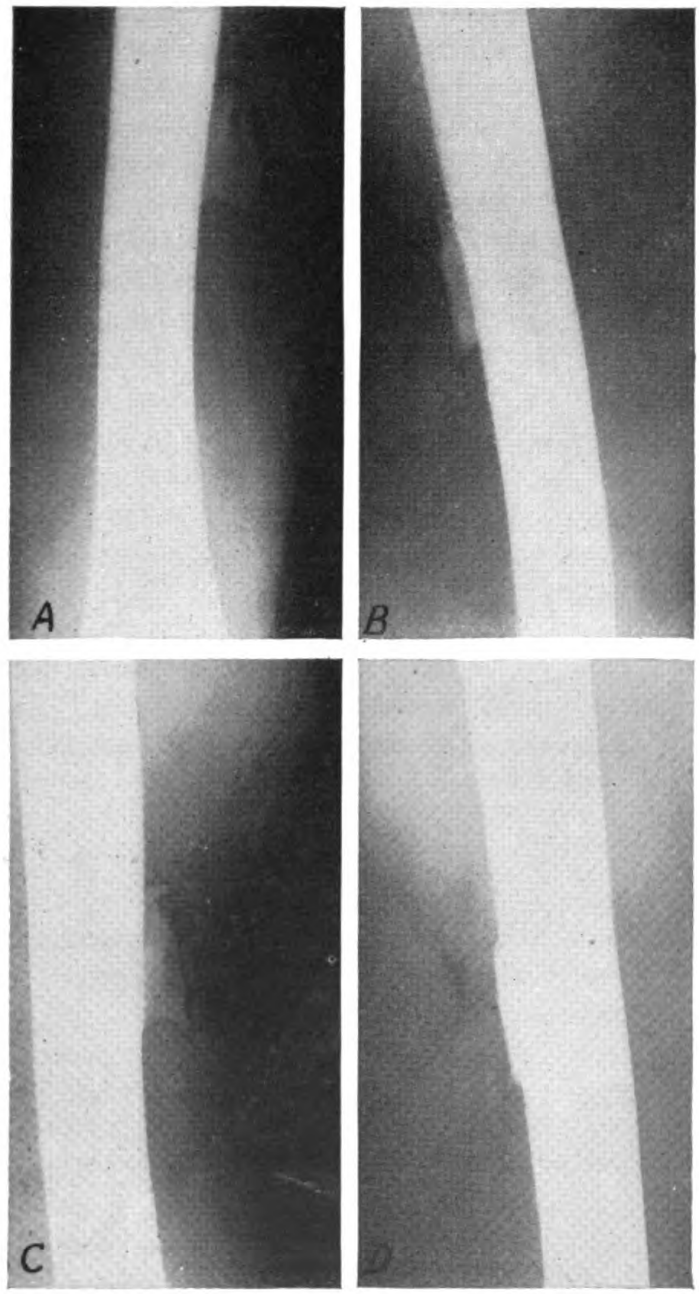


4. Case 4. (A) taken 13 September 1944, and (B) taken 2 weeks after operation, showing recalcification following surgery.

Case 5.—This cadet injured his right arm on 30 September 1944, playing football. Roentgenographs taken on 2 October showed no abnormality, but the arm was very sore and swollen. On 6 November the roentgenograph did show patho-

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logic changes. This patient was given daily heat treatments. The latest roentgenograph taken on 16 February 1945 showed persistence of the ossification, although the patient had no complaints and the lump is definitely smaller in size (fig. 5).



5. Case 5. (A) and (B) show anteroposterior and lateral views taken on 6 November 1944, 1 month after injury. (C) and (D) show the extent of the absorption in 3 months.

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Four of these cases were the result of football injuries and one resulted from playing soccer. This represents more than 1 percent of the men playing football for the season.

This seemed a rather large number of cases to observe in one season in this activity and aroused considerable speculation as to whether an equal percentage of such cases occurred elsewhere. It also brought up the question of the subsequent progress of the condition, in view of the fact that occasional cases of malignant degeneration in these areas of calcification have been observed. Three cases of sarcomatous degeneration of ossifying myositis were reported by Pack and Braund. Four other cases have been reported by Shipley (*2*), one by Cone (*3*), and one by Butler and Woolley (*4*). They point the possibility of some of these conditions suddenly undergoing malignant changes.

SUMMARY

Five cases of ossifying myositis are reported, four of which were the result of football injuries, representing over 1 percent of the cadets actually participating in the sport. Translating this proportion to the number of people engaged in football throughout the country we would have far more cases reported than heretofore. The potential dangers of this condition are pointed out. The use of x-ray therapy is suggested.

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PRODUCTION OF EXTRACELLULAR PENICILLIN-INACTIVATING SUBSTANCES

A potent penicillin-inactivating substance is produced by penicillin-resistant Staphylococcus aureus but not by penicillin-sensitive strains. The substance is soluble and diffuses readily into both liquid and solid culture medium. The variation of susceptibility to penicillin among different strains of Staphyloccus aureus appears to be associated with a difference in this enzyme formation.—GOTS, J. S.: Production of extracellular penicillin-inactivating substances associated with penicillin resistance in Staphylococcus aureus. Proc. Soc. Exper. Biol. & Med. 60: 165–168, October 1945.

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1,265 PNEUMONIA CASES WITH NO DEATHS

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During the 4 months ending 12 April 1945, 1,265 cases of pneumonia were observed and treated in the pneumonia wards of the McIntire Unit, U. S. Naval Hospital, Great Lakes, Ill. All patients were males, their ages varying from 17 to 47 years; the majority were in the 17-to-30-year group.

Winters in the Great Lakes area are usually severe. Snow fell early in December 1944, and continued through the following months until March. Coincident with the snow, ice, and rain, the mean temperature remained well below average. The weather was "ideal" for the contraction of pneumonia. In addition to an unusually large number of pneumonia cases, other acute infectious and contagious diseases were above the normal expectancy for this season of the year. Of the contagious diseases, scarlet fever was particularly prevalent and severe, and was associated with measles, mumps, German measles, acute catarrhal fever, tonsillitis, and diphtheria. It may be stated, therefore, that resistance to acute infectious diseases was generally poor.

Noteworthy was the fact that many of these men contracted pneumonia early in their "boot" training, sometimes within a few days after leaving home. Many came from the South and other parts of the United States where exposure to severe elements is not usual. Other contributing factors were (1) a state of fatigue which followed inoculations and vaccinations without subsequent rest, (2) the extraction of from 1 to 14 teeth, (3) chills from swimming or following fire-fighting exercises, (4) inhalation of dust particles caused by cleaning of barracks decks with steel wool, (5) overcrowding, poor ventilation, and the lack of heat control in barracks, and (6) crowding at many spectator events.

Late in 1944 and continuing until 15 February 1945, a sulfadiazine prophylactic program was re-instituted in many of the camps and activities of the Great Lakes Naval Training Center. All persons in these areas were given 1 gram of sulfadiazine with an equal amount of sodium bicarbonate daily. Despite sulfadiazine prophylactic program, the admission rate of pneumonia cases increased. Sulfadiazine in the recommended doses had little or no effect on the causative organisms in pneumonia. Therefore it may be assumed these organisms were resistant to the prescribed doses of the drug.

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Efforts were made early to determine the bacterial causes of all cases of pneumonia. Upon admission routine sputum typing (Neufield method), blood cultures, and sulfonamide levels were obtained. Most of these examinations yielded negative findings or were of little value. Eventually they were discontinued.

In most cases the patient had a history of a preceding upper respiratory infection. Very few of the patients treated in this series had had scarlet fever recently. The common subjective symptoms dating the onset of pneumonia were chills, fever, cough, chest pains, and frequently hemoptysis. Observation of the following classic signs were noted: Flushed face, an anxious expression, herpes of the lips and face, distressed rapid breathing sometimes accompnaied by an expiratory grunt, cyanosis of some degree, and sweating. Local chest findings varied with the stage of the disease or with the kind of pneumonia, as lobar, bronchial, or primary atypical. However since a majority of cases were lobar in character, slight to pronounced dullness, diminished breath sounds, crepitant râles, and restriction of motion of the chest wall were common findings.

Upon admission, laboratory work in all cases consisted of a white blood cell count, differential count, hemoglobin determination, complete urinalysis, and x-ray examination of the chest. White blood cell counts and urinalyses were repeated daily while the patient was receiving sulfadiazine. The leukocyte count with few exceptions was constantly elevated except in the primary atypical pneumonias. These counts were at nearly normal levels. In the more seriously ill patient, red blood cell counts and plasma protein determinations were ordered as often as was necessary. In many cases the seriousness of the pneumonia process was not directly parallel to the x-ray findings.

TREATMENT

Early in the season sulfadiazine was used almost exclusively, penicillin being reserved for those not responding to sulfonamide therapy. The introduction of penicillin as a routine measure in treatment greatly shortened the course of the pneumonia. An interesting observation was that the earlier penicillin was instituted, after sulfadiazine had been administered, the more quickly the patient's temperature returned to normal. It was also noted that when penicillin alone was administered, the response was not so remarkable as when penicillin and sulfadiazine in combination were used.

Routine ward management for pneumonia was instituted, particular emphasis being placed on the importance of blood and urine examinations in order to prevent, as far as possible, any complications arising from the use of sulfadiazine. Previous experience and current ob-

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servation showed that a leukocyte count over 10,000 was a safe level, permitting the use of sulfadiazine; whenever the white blood cell count was less, sulfadiazine was discontinued. The following routine orders were posted on all pneumonia wards and were made available to all medical officers, hospital corpsmen, and nurses.

1. Penicillin, 20,000 units intramuscularly on admission; 10,000 units every 3 hours unless otherwise specified.

2. (a) Sulfadiazine, 2 to 4 grams with an equal amount of sodium bicarbonate on admission when the white blood cell count was 10,000 or over and depending on the temperature and obvious illness of the patient. Repeated sulfadiazine and sodium bicarbonate, 1 gram of each every 4 hours around the clock; (b) sulfadiazine discontinued if the white blood cell count was less than 10,000 or if the urine revealed sulfonamide crystals, blood, or albumin.

3. One thousand cubic centimeters of physiologic sodium chloride solution with 5-percent dextrose intravenously for patients with high temperature or signs of dehydration; fluids freely by mouth. Water balance chart for intake and output of all fluids.

4. Oxygen mask, tent, or nasal catheter for cyanosis, rapid pulse (120 or more per minute), or dyspnea.

5. Morphine sulfate, ⅙ grain hypodermically, for severe pain, or codeine sulfate, 1 grain, for pain, restlessness, or severe cough.

In addition to the routine combined use of penicillin and sulfadiazine, red blood cell counts and blood protein determinations were made on all patients considered seriously or critically ill. Whole blood and plasma transfusions were administered freely and were repeated as often as necessary to restore these substances to their normal levels. The early appraisal of the need for these procedures was doubtless of great importance.

In the treatment of pneumonia excellent nursing still remains an item of major importance. In the McIntire Unit pneumonia wards, hospital corpsmen and nurses were specially trained to recognize significant and unusual symptoms of pneumonia. In additon to general care, nurses, and hospital corpsmen became most efficient in the control of oxygen administration and in observing accurately the fluid intake and output. They also became alert at recognizing abnormal laboratory findings as indications for the special care of the more seriously ill. The survival of many critically ill patients was attributed to the constant watchfulness of the hospital corpsmen and nurses and to the retention of those persons on the pneumonia service whose cooperation so greatly assisted in obtaining the desired results.

The incidence of lobar pneumonia far exceeded that of bronchopneumonia. Primary atypical or virus pneumonia occurred infrequently. The lobar and bronchial forms responded readily to sulfonamide and penicillin therapy, whereas the atypical form failed to respond to sulfadiazine and only occasionally was considered to have been benefited by penicillin.

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During the period of convalescence all pneumonia patients were allowed various phases of guarded activity. Penicillin administration was continued until the patient's temperature remained normal for approximately 3 to 5 days. At the conclusion of this period he was allowed head privileges. If in 1 or 2 days he continued to be fever free, he was allowed out of bed for periods which gradually increased in time until he became an "up" patient. Regulated rest periods were held daily from 1 to 2 hours in the afternoons. Eventually these men were assigned light ward details and if this work was tolerated, more strenuous details were allowed. Each patient had a trial at some outside detail before he was discharged to duty. Sedimentation and x-ray examinations were repeated at intervals. Requirements for discharge to duty were (1) a patient must have regained his normal weight, (2) his sedimentation rate must be within normal limits, and (3) his chest must be normal on physical and x-ray examination. With observance of these requirements, only five patients had recurrent attacks of pneumonia.

COMPLICATIONS—INCIDENCE AND TREATMENT

Serofibrinous pleurisy was by far the most common complication and in some respects presented a problem more serious than ordinarily encountered or expected. Of the total number of patients with pneumonia in whom the diagnosis was definitely established by x-ray and physical findings, 8.2 percent developed a pleural effusion. During the time of the highest incidence of admissions and when it was thought the virulence of the offending organisms was at its apex, the occurrence of pleural effusions early in the disease was common and extremely severe.

TABLE 1.

	No. cases	*Percent*
Total cases pleural effusion	104	8.2
Cases tapped	96	92.3
Leukocytes in smear	78	75
Positive culture (streptococcus)	9	8.65
Cases not tapped	8	7.7

A total of 39 cases, or 3 percent of the entire series, developed a suppurative pleurisy or empyema. Of this number 9 cases, or 8.65 percent, were shown to be associated with either the Streptococcus pyogenes or Streptococcus salivarius. Of these, 4 cases required surgical drainage after repeated thoracentesis, saline irrigations, and instillations of penicillin locally into the pleural cavity. The other 5 cases were treated successfully by repeated thoracentesis, saline irrigations, and instillations of penicillin.

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Of the total number of cases of empyema, 19, or 18.27 percent, required open surgical drainage by rib resection, even after repeated aspirations and instillations of penicillin into the empyemic cavity. Twenty cases, or 19.23 percent, were successfully treated by the method of repeated aspirations, irrigations, and instillations of penicillin.

TABLE 2.—*Percentage of all effusions*

	No. cases	Percent
Total cases of empyema	39	37.5
Cases treated by open drainage—rib resection	19	18.27
Cases treated by repeated aspiration, irrigation, and penicillin locally	20	19.23

The serious complication of pericarditis occurred in four cases or 0.3 percent. Diagnosis was established by clinical findings, x-ray, and electrocardiographic studies. Surgical intervention or tapping of the pericardial sac was not necessary.

The absence of mortality in this series of 1,265 cases of pneumonia can be attributed to the following factors: (1) The combined use of sulfadiazine and penicillin and the discontinuance of sulfadiazine for those patients having a white blood cell count of less than 10,000 cells per cubic millimeter; (2) the recognition and maintenance of nearly normal red blood counts and blood protein levels; (3) good nursing care by a staff of hospital corpsmen and nurses especially trained in the management of pneumonia patients; (4) the fact that the majority of the patients were in the decades of life when resistance to pneumonia is the highest; and (5) the unknown but probable low virulence of the infecting organisms.

CONCLUSIONS

1. Good nursing care continues to be of great value in the treatment of pneumonias.

2. The use of sulfadiazine and penicillin in combination appeared to be more effective than either alone.

3. The laboratory can render most important service by making frequent leukocyte counts in patients receiving sulfadiazine and by determining the plasma proteins in those who are seriously ill.

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EFFECT OF BLOOD DONATIONS ON BLOOD PRESSURE OF HYPTERTENSIVES[1]

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While assigned to duty at an American Red Cross Blood Donor Center, the authors became impressed with the desirability of studying the effect upon the blood pressure of hypertensives when 500 cc. of blood was withdrawn from the circulatory system. The loss of blood in moderate quantities from persons with hypertension seems to have a beneficial effect, if only upon the feelings of the patient, though the literature is singularly sparse in observations on the subject.

All participants in our study were donors who had blood pressures above 150 systolic. They were interviewed by one of the authors (J. W. E.) in an attempt to weed out those whose blood pressures were likely to be elevated by emotional stress or apprehension. All participants had made at least one blood donation at this center and were of a phlegmatic type. Those who seemed to be emotionally perturbed were not used. Blood pressures were taken immediately before the blood-letting, ½ hour afterward, 24 hours after, and again 1 week after. Practically all blood pressure determinations were made by one physician; in several instances they were made by another person who had shown by numerous checks that his readings were always within 4 millimeters of mercury of those made by the physician who made the bulk of the determinations.

We feel that it is of great importance to show some of the individual records of the donors because of the fact that averages and percentages of the entire group do not adequately portray the individual responses to the blood-letting. Space would not permit the reproducing of all the records, but 15 of them are shown in table 1.

These 15 are not selected records, but rather are records drawn at random from the entire group—3 for each 5-year age period represented. An analysis reveals that out of the 60 re-donors studied, 24, or

[1] From the American Red Cross Blood Donor Service.

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40 percent, showed an actual rise in systolic pressure at the end of ½ hour following the donation; 9 of them showed increases of 10 points or more, with the greatest showing an increase of 30 millimeters of mercury. In 29, or 48 percent, there was a rise in diastolic pressure of from 2 to 20 points; the rise of the diastolic pressure practically always accompanied systolic rise, particularly in those with the greater increases in systolic pressure. The elevation of the systolic pressure in the hour following blood-letting is of tremendous importance; certainly it implies a tacit warning against indiscriminate blood-letting either as an altruistic or therapeutic measure.

In the 24-hour determinations there were 4 donors who showed an increase in systolic pressure over that observed before donation. It is significant that all of these were donors who had not shown a systolic increase at the end of the ½-hour period. There were 8 who showed slight to moderate diastolic increases.

In the determinations made after 1 week we find some interesting figures. Four donors, 6.6 percent, were actually found to have increases of 2, 22, 2, and 20 points of systolic pressure; 3 of these showed a corresponding increase in diastolic pressure of from 10 to 20 points. There were 4 who showed small increases in diastolic without increase in systolic pressure. Taking the group of 60 re-donors as a whole, table 2 shows the averages and percentages.

TABLE 1.—*Blood pressures of 15 re-donors (hypertensives)*

Age of donor	No. of donations	Pressure before donation	½ hour later	24 hours later	1 week later
39	6	196/106	180/98	190/108	162/84
39	2	176/100	180/104	154/94	154/96
39	2	166/100	158/100	140/94	158/74
41	3	220/120	218/124	190/120	194/114
43	4	178/114	182/90	146/90	148/84
44	7	163/100	156/98	152/80	150/90
46	3	172/88	166/84	158/80	150/84
46	2	180/100	----------	158/94	154/98
47	3	190/100	174/98	160/84	166/88
51	3	210/118	212/120	170/100	178/112
51	5	176/84	190/88	----------	164/88
54	4	182/96	168/98	138/80	138/84
55	4	180/90	180/90	170/90	174/88
57	7	188/104	192/100	178/100	180/98
59	2	190/100	202/120	184/90	184/100

Originally we had hoped to be able to make observations covering a period of 8 weeks, the minimum length of time which must elapse before persons can donate blood again. The difficulty in getting the cooperation of donors has made it unfeasible to give more figures on the group of 60 hypertensives under discussion. However we have been able to make a survey of over 200 hypertensive re-donors and can state definitely that in the great majority of them the clinical course of

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their hypertension is not permanently affected. From those whom we have been able to observe at weekly intervals we have found that the lowered blood pressure remains for from 3 to 6 weeks in the majority of cases, and then gradually rises again so that by the end of from 4 to 8 weeks it has regained its predonation level. About 80 percent of these donors felt definitely better than they had felt before the donation, many of them stating that it seemed as though a great load had been lifted from their shoulders; usually this feeling of well-being persisted for about 1 month. About 17 percent did not notice any definite change for better or for worse. Three percent stated that they did not feel as well for a few days.

As a further check on the accuracy of our figures, we collected data on a group of 18 first-time hypertensive donors who met the requirements mentioned. This group responded by showing wider variations in all periods observed, differing most markedly from the re-donor group of 60 in the first readings taken (½ hour after bleeding), and more nearly approaching the re-donor group on each successive period, so that the readings taken after 1 week post-bleeding fairly approximated those of the re-donor group.

TABLE 2.—*Blood pressures of 60 re-donors (hypertensives)*

	Before donation	½ hour later	24 hours later	1 week later
Average	183. 3/99. 0	176. 4/97. 9	164. 9/97. 8	164. 8/90. 3
Average change (lower)		6. 9/1. 1	18. 4/2. 2	18. 5/8. 7
Percent lower		3. 79/1. 11	10. 00/2. 20	10. 10/8. 78

Table 3 gives the average pressures taken at the usual intervals on a group of 19 donors of all ages with normal blood pressures.

TABLE 3.—*Blood pressures of 19 donors with normal blood pressures*

	Before donation	½ hour later	24 hours later	1 week later
Average	123. 4/76. 9	121. 4/76. 9	123. 0/74. 4	122. 1/74. 6

The uniformity of the average pressures in all observation periods is indeed striking when compared with the variations shown in the hypertensive group.

An interesting side light gleaned from this study is the high incidence of hypertension noted in parents or other members of the families of donors. Out of 100 hypertensive donors questioned along this line, 54 gave a definite history of hypertension in family members;

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9 knew enough of the circumstances of their parents' deaths so that we were able to deduce that they had suffered from hypertension. Twenty-three of these donors did not know whether hypertension existed in other family members or not; and 14 gave a definitely negative history of family hypertension.

CONCLUSIONS

1. The taking of 500 cc. of blood from selected hypertensives results in a gratifying drop in blood pressure in about 95 percent 1 week after withdrawal of the blood.

2. The taking of 500 cc. of blood in certain hypertensives is a justifiable therapeutic procedure; indeed this is true not only because of the temporary lowering of blood pressure but also because of the very noticeable feeling of well-being experienced by most of these people.

3. The taking of the blood does not permanently alter the clinical course of the hypertension; it merely provides several weeks of actual lowering of blood pressure, usually accompanied by symptomatic relief lasting about 1 month on the average. At the end of 8 weeks the blood pressure is usually back to its predonation level or higher. Subsequent bleedings at 8-week intervals do not effectively deter the blood pressure in its ultimate ascent.

4. Because of the relatively high incidence of systolic rise immediately following withdrawal of 500 cc. of blood, care must be exercised in those people who present systolic pressures above 200, or in whom age or objective findings would indicate fairly marked arteriosclerotic changes. This caution must be extended also to persons with relative or actual valvular insufficiency.

5. The incidence of occurrence of hypertension in several members of the same families is startling. We feel that we can definitely state that it existed in at least 63 percent of 100 hypertensive donors questioned. We do not state that all of these are manifestations of hereditary vascular disease, but we do feel that the incidence is high enough to warrant further investigation, particularly from the standpoint of determining some prophylactic regimen for the offspring of known hypertensive parents.

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INTRAVENOUS ADMINISTRATION OF MORPHINE TARTRATE

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No reports were found in the literature on the intravenous administration of morphine tartrate. Inasmuch as this drug in Syrettes is part of the standard medical equipment of the Army and Navy, a discussion of its intravenous use is considered pertinent.

The speedier relief of pain which the intravenous administration of morphine tartrate affords is worthy of note. The lag between the subcutaneous injection of morphine and relief of pain results in an interval of needless pain for the sufferer, and this interval is prolonged in shock due to faulty absorption. During this interval the morale of the bystanders is lowered by thoughts of how much pain they would have to endure if they in turn became a casualty. More important, the bystanders often urge the medical officer or hospital corpsman to "do something" to relieve the patient's pain. This frequently results in the injection of a second Syrette of morphine tartrate (total dose, 1 grain) with the result that the respirations become dangerously depressed.

The administration of two Syrettes is sometimes spoken of as "double dosage," but this double dosage is usually, of course, nothing more nor less than overdosage, an error as old as the drug itself. When the patient who has received a grain of morphine tartrate arrives at a field hospital, and an operation becomes necessary, he presents a problem. During operation under ether, he will frequently stop breathing. In addition to the hazards of respiratory depression, the operating time is thus needlessly prolonged. An occasional fatality will result from these causes.

The administration of two Syrettes (1 grain) of morphine tartrate is especially common in gunshot wounds of the abdomen because of the excessive pain these patients suffer. Excessive dosage is especially undesirable in this group, as they almost always require operation. The harmful overdosage generally is the result of the desire of the medical attendant to allay pain speedily, and of the slow action of subcutaneously administered morphine tartrate. It is with the latter of these causes that we are concerned here; the remedy for slow absorption of subcutaneous morphine tartrate is intravenous administration of the drug.

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With these thoughts in mind several studies were conducted on two non-Naval personnel who were suffering from malaria and malnutrition. Morphine sulfate, 1/8 grain, was administered intravenously over a period of 2 minutes to each of the subjects, and they were observed for 2 hours. Respirations per minute were lessened, there was moderate lowering of blood pressure, and the pupils became pin-point. On the following day studies were carried out on subject number one, who was 27 years old, with the following results:

At 1400 his pulse was 84, respirations were 16 per minute, and blood pressure was 104/62. At 1405, ¼ grain of morphine tartrate was injected intravenously over a 2-minute period. The subject complained that his head was swimming.

At 1410 he closed the eyes but did not sleep. The pulse rate was 88 and respirations 14 per minute. Fifteen minutes later the pulse rate was 96 and respirations were 16 per minute. At 1445 he complained of his mouth being dry. The pupils were moderately constricted, but not pin-point. The pulse rate was 96; the respirations were 7 per minute. By 1500 the pulse rate was still 96, and the respirations were 8 per minute, rising to 12 in the next 35 minutes while the pulse rate remained constant. At 1610 the pulse rate rose to 100, and respirations were 12 per minute, and by 1630 the pulse rate had dropped to 76 and the respirations to 10 per minute.

The second subject was 24 years old. At 1430 his pulse rate was 76, and respirations were 18 per minute. Five minutes later ¼ grain of morphine tartrate was administered intravenously over a period of 4 minutes, and another ¼ grain was administered subcutaneously by withdrawing the syrette needle from the vein and injecting the remaining half into the subcutaneous tissue. Ten minutes later the pulse rate was still 76 and respirations were 10 per minute. The pupils were small, but not pin-point. The following readings were obtained: At 1500—pulse 84, respirations 8; at 1515—pulse 68, respirations 9; at 1540— pulse 68, respirations 11. The pupils were very small. At 1610—pulse 76, respirations 12; and at 1630—pulse 68, respirations 10.

Neither of the two patients showed any ill effects from the morphine tartrate. It is interesting to note that the respirations in case number two were depressed from 18 to 10 per minute within 10 minutes.

It is desirable to administer the drug *slowly* and to question the patient about his pain. The administration should be stopped after relief of pain is obtained, or in some cases the remainder of the syrette may be given subcutaneously. Five minutes should be taken to inject ¼ grain of the drug. Transient dizziness will usually be the only ill effect observed.

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CLINICAL NOTES

UNUSUAL CONDITIONS AGGRAVATED BY SEASICKNESS

REPORT OF TWO CASES

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The following two unusual case histories were obtained aboard an APA during one cruise in moderately rough weather. They represent conditions that were precipitated, though probably not initiated, by mal de mer.

CASE REPORTS

Case 1. (*Tetany*).—An officer, 25 years of age, had been seasick for 3 days. At the completion of a 4-hour watch on the bridge, during which time he vomited at 30-minute intervals, he suddenly began to hyperventilate. His arms and fingers stiffened and he fell to the deck semiconscious and rigid. A moment later, when medical aid arrived, he was found to be in carpopedal spasm, blowing air violently through pouted lips, and unable to talk. He did, however, appear vaguely aware of his predicament. He was given an injection of 20 cc. of 10-percent calcium gluconate solution. Rebreathing into a paper bag also aided in effecting complete recovery and relaxation of the spasm in 10 minutes. He had a slight chill and suffered emesis during the administration of 1,000 cc. of 5-percent dextrose in saline solution which was administered after he recovered from the tetany. The urine was alkaline in reaction.

Two years previously, 8 hours after a typhoid inoculation, the patient had had a mild attack of stiffness of the fingers and hyperventilation, from which he recovered after several days' rest in bed. A second attack occurred the day after his father's death, and was likewise not very severe.

Case 2. (*Subcutaneous emphysema*).—An 18-year-old enlisted man complained of difficulty in swallowing, and swelling of the neck, which had come on during the past 8 hours. He felt weak and had vomited energetically for the past 2 days. The medical history was entirely irrelevant. The patient's face was flushed, but he appeared to be in no distress. The neck was swollen.

Palpation revealed an extensive area of crepitus extending from the mandibular region to the sternum and bounded laterally by the sternocleidomastoid

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muscles. It extended into the left axilla as far as the posterior axillary line and forward and down to the costal margin. There was no crepitation over the left pectoralis major muscle. Neither dilation of the neck veins nor any abnormal cervical pulsation was noted. The chest expanded well. There were nonpersistent moist râles scattered throughout, posteriorly. The cardiac apex was just within the nipple line, and no abnormalities in intensity, rhythm, or sounds were detected. The man appeared to be drowsy.

A roentgenograph of the chest made with a portable machine showed no evidence of pneumothorax, or increase in size of the mediastinum. The heart appeared normal in size and position. The diaphragm moved freely during fluoroscopic examination. The erythrocytes numbered 4,650,000 per cu. mm. of blood and the leukocytes 7,200, with a differential count of 72 percent polymorphonuclear leukocytes and 28 percent lymphocytes.

The patient's blood pressure was taken at 30-minute intervals. On admission it was 145/90, and rose steadily until 6 hours later when it was 190/130, and did not fall to 120/80 until the end of the first day. Pressure was approximately equal in all extremities. The hypertension was accompanied by a slight increase in the pulse rate. The patient did not cough until the second day. He then began to raise an increasing amount of purulent sputum, which contained several cubic centimeters of fresh, unstreaked blood on the third day. The sputum was not frothy and not of foul odor. It was found to be loaded with polymorphonuclear leukocytes and contained a few diplococci. No acid-fast organisms were detected. The patient's temperature did not exceed 99.2° F. and he did not complain of chest pain, nor did he experience any difficulty in breathing, although dysphagia persisted. All solid food given for the first 3 days was regurgitated.

The subcutaneous emphysema resorbed gradually so that it had vanished by the end of the first week. He mentioned a numb sensation in the right arm and hand which subsequently disappeared. Further study ashore failed to shed any new light on the case. The cough and hemoptysis were not observed during the second week, and the man no longer regurgitated his food. X-ray studies of the chest showed no pathosis. The sputum was negative for tubercule bacilli on repeated examination.

COMMENT

These cases must have had an underlying pathologic process quite independent of the seasickness which precipitated the clinical picture in each. In the first, it is believed that there was an element of hysteria. It may be conjectured that the officer could have initiated the attack of tetany by forced hyperventilation, and the alkalosis produced by repeated vomitings made the attack severe and immediate. The cause of the subcutaneous emphysema in the second case is obscure. An apical lung abscess with pleural thickening and adhesions might be suggested. It is quite possible that this could have been present without appearing in anteroposterior chest roentgenographs. The carotid sinus in this case might have caused a reflex hypertension due to constriction of the carotid artery below the sinus by the air in the subcutis. This could account for the drowsy state of the patient on admission.

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CUTANEOUS DIPHTHERIA

JACK V. CHAMBERS
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Numerous cases of cutaneous diphtheria have been reported in the literature. Cameron and Muir (*1*) reported 66 cases of cutaneous diphtheria in a British Yeomanry unit station in Northern Palestine from September to December 1942. Bensted (1936) (*2*) reported an outbreak of diphtheria among British troops of the Northwest Frontier. In his 46 cases there were 31 of cutaneous diphtheria. Fitzgerald and Robertson (1917) (*3*) found Corynebacterium diphtheriae to be present in 32 cases of 67 suppurating wounds of amputated stumps of Canadian soldiers. Kirk (*4*) recently commented on minor epidemics of skin diphtheria among American soldiers in the Pacific area and Dieuaide described a small epidemic of skin diphtheria in the New Hebrides and stated that this disease had been found in this war in North Africa, in India and in the Pacific.

Cameron and Muir state that cutaneous diphtheria is encountered in two forms, acute and chronic. The acute form is always associated with a positive lesion in the throat, or more commonly the nose. The chronic form is superimposed as a skin lesion, which might be any form of skin disease.

Tauber and Goldman (*5*) differentiate the lesions into acute and chronic primary diphtheria of the skin. In the acute form the bacterial flora of the lesion is predominantly or entirely diphtheritic even from the onset. In the chronic form the cutaneous lesion is not initiated by the diphtheria organisms, but by some other organism, and the diphtheria bacillus is superimposed.

The source of the infection frequently remains undetected in isolated cases. In epidemics it is usually traced to one or more carriers. Fitzgerald and Robertson described a series of 32 patients in whom the source of infection was probably a diphtheritic lesion on the finger of a nurse. Climate, abrasions, lack of facilities during combat to keep the skin clean, insect bites, trauma, and fatigue all play a part. In minor epidemics a search for and segregation of carriers should be instituted immediately and isolation technic carried out on those already infected with cutaneous lesions.

An acute diphtheritic infection of the skin may be suspected when

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blister sores appear on the forearm or hand of patients suffering from active nasal or faucial diphtheria, or when a pre-existing skin lesion in any part of the body becomes obviously exacerbated and develops a yellowish membrane or dark leathery slough; also when a patient presents himself with an indolent ulcer with hard, raised, and rolled edges of a pale bluish tinge, and covered with a hard leathery black scab.

The diagnosis of a cutaneous diphtheritic lesion can only be established with a surety by a competent laboratory technician. An infection due to Staphylococcus aureus may so closely resemble infection due to C. diphtheriae that without bacteriologic examination the nature of the infection cannot be determined. Diphtheroids may frequently confuse the picture.

Considerable local pain may exist at the site of the lesion, and systemic symptoms of varying degrees may be present, depending entirely on the virulence of the Corynebacterium diphtheriae. Bensted reported 3 cases of paralysis in 31 cases of cutaneous diphtheria, and Walshe (1918) (7) also noted it in association with cutaneous lesions. The length of time required for these infections to heal varies considerably. Fitzgerald and Robertson reported it as from 2 to 8 weeks after the nature of the infection was established. Cameron and Muir reported about the same length of time necessary for healing, but reported 1 case with unhealed sores for 8 months.

The treatment carried out in the cases reported in the literature has consisted of antitoxin, 20,000 to 40,000 units, supplemented with bed rest, hot fomentations, and isolation technic.

The following case was proved to be cutaneous diphtheria by cultural characteristics and fermentation reaction. Unfortunately no guinea pigs were available for determination of the virulence of the organism.

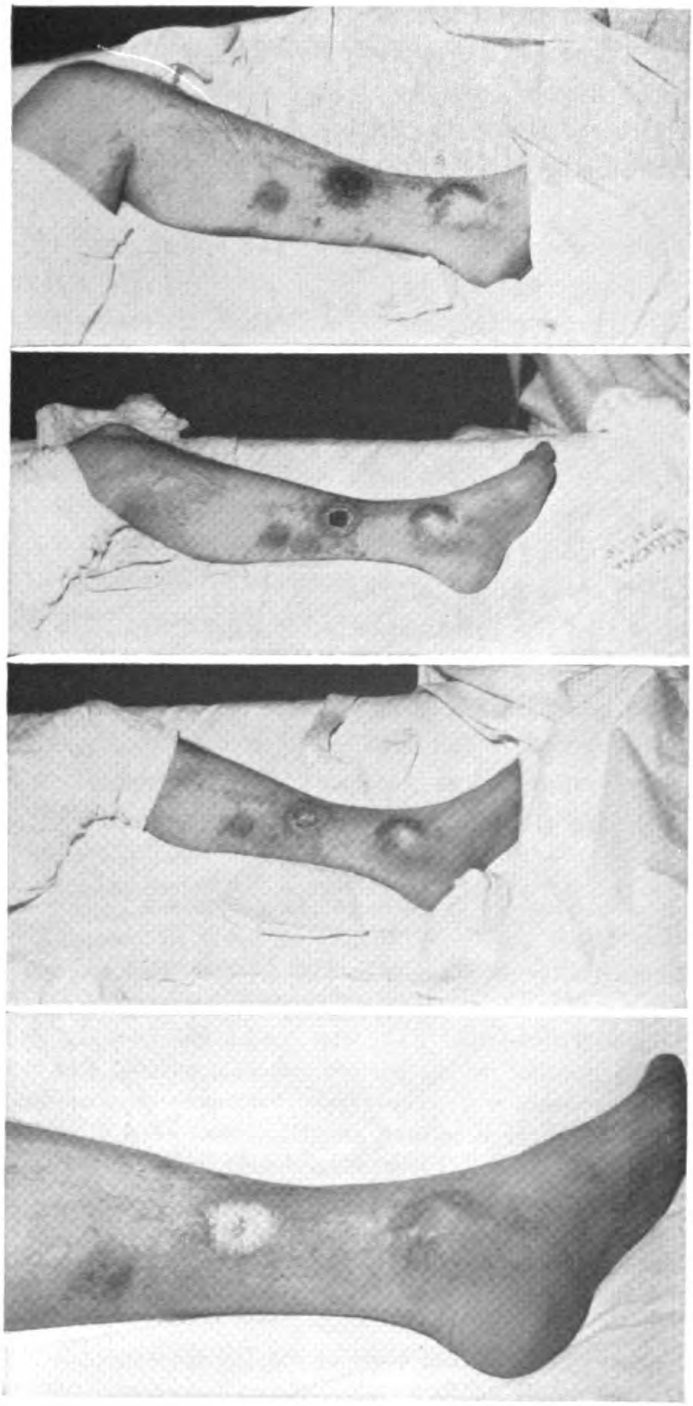
Case report.—The patient, a 35-year-old white male, had a blister appear on the medial aspect of the left lower extremity 9 months prior to the present admission, while at sea. This lesion progressed in size and formed an ulcer about the size of a dime with a yellowish crust on it. With hot compresses and bed rest the ulcer healed in about 2 months. He was discharged to duty and sent to the West Coast. Three months later the ulcer again appeared and the patient reported to the sickbay, where a powder (type unknown) was applied locally on several occasions. The ulcer remained about the size of a dime for the next 2 months and then gradually became larger and formed a black leathery crust. He was readmitted to the hospital and remained on a surgical ward for 6 weeks. No smears or cultures were taken at that time. He was then transferred to a convalescecnt hospital with the black leathery crust still present. After 49 days he was retransferred to this hospital with the ulcer and black scab unchanged in appearance and causing him considerable pain.

Physical examination revealed a large round ulcer on the medial aspect of the left lower extremity with raised rolled edges of a bluish tinge, covered with a

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hard leathery scab. A small amount of induration was present around the ulcer. There was no popliteal or inguinal adenopathy.

White blood cell count showed a leukocytosis of 11,300 with a normal differential count. The blood Kahn test was negative, and erythrocyte sedimentation rate was 9 mm. in 1 hour. Smear and culture showed Corynebacterium diphtheriae. Smear and culture of the nares annd pharynx were negative for C. diphtheriae.



A. Diphtheria ulcer of the leg in case presented, with black leathery scab and bluish rolled edges.

B. Ten days after antitoxin was given. Note slough around edges of eschar.

C. Seventeen days after antitoxin had been given. Cultures and smears still positive for Corynebacterium diphtheriae.

D. Eight weeks after initial treatment. Ulcer completely healed.

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The patient was given 40,000 units of diphtheria antitoxin, and warm applications of a solution of 20 units of antitoxin to 1 cc. of physiologic saline were applied locally. Six days later a beginning slough around the edges was taking place. Another 20,000 units of antitoxin was given and further slough was noted. Seventeen days after the initial dose of antitoxin the black eschar had completely sloughed, but daily smears and cultures remained positive for C. diphtheriae. The Schick test was negative.

The patient was then given 600,000 units of penicillin over a 6-day period, and local compresses of 100 units of penicillin to 1 cc. of triple-distilled water were applied locally.

At the end of this period of time the smears and cultures were negative for Corynebacterium diphtheriae for the first time. Clean granulation tissue appeared in the ulcer base, and epithelization took place with great rapidity.

SUMMARY

The possibility of cutaneous diphtheria should always be kept in mind as a differential diagnosis.

In view of the chance of paralysis, diphtheria antitoxin should be given in all cases of cutaneous diphtheria. As diphtheria antitoxin neutralizes the toxin of the diphtheria bacillus and is not directly antibacterial; the apparent results of its use in this case must be explained on the basis that in neutralizing the toxin, which acts as a local irritant, the local tissue defenses of the body were then capable of bringing about resolution and repair at the ulcer site.

With the use of penicillin, this resolution and repair far excelled that when the antitoxin alone was used. Penicillin, which acts as a bactericidal agent, destroyed the Corynebacterium diphtheriae, as proved by the negative smears and cultures 5 days after its instigation, and by the rapid healing which took place.

A positive reaction to virulence test is of great aid in the diagnosis of diphtheria of the skin but is not entirely necessary (*6*). In the case reported, the clinical features, the presence of diphtheria-like organisms in the smear, the cultural and fermentation reactions of the organisms, and the response to specific treatment eliminated any doubt as to the nature of the ulcer.

CONCLUSIONS

1. Any chronic or acute ulcer with a black leathery scab on its surface and with rolled bluish edges should suggest cutaneous diphtheria.
2. Cultures and smears should be taken routinely on all ulcers failing to respond to treatment.
3. Antitoxin should be administered to counteract possible paralysis.
4. In this case penicillin brought about more rapid healing and disappearance of the organisms from the ulcer than did antitoxin alone.

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OCCLUSIVE DRESSING FOR TROPICAL ULCER

Desert sores and similar conditions respond best to an occlusive method of treatment. An adhesive plaster of paris dressing has proved successful in the treatment of this condition.

The dressing consists of a powder rubbed into the mesh of an open-weave bandage, as it would be for a prepared plaster of paris bandage. The powder is composed of plaster of paris 75 percent and tragacanth powder 25 percent, to which is added acriflavine powder to give a strength of 1: 1,000. Other antiseptics such as gentian violet or sulfanilamide may be used. The powder must be thoroughly mixed and finely ground.

Indolent ulcers, which are frequently met, respond well to an application of silver nitrate and sealing with the patch.

The dressing has been used with success in the early vesicular stage of desert sores, early treatment of boils, in treatment of impetigo, and particularly in abrasions and minor wounds of the head and face. The dressing has been applied over small lacerations, and in all cases rapid healing has been obtained.

This method of treatment is extremely economical. It is comfortable, does not restrict movement, and there is no irritation of the skin—HAMMOND, A. G.: Occlusive dressing; the almaza patch. East African M. J. 22: 241–242, July 1945.

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PENICILLIN REACTION

REPORT OF A CASE

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Because of the few toxic reactions reported from penicillin, it is believed the following case is of interest.

Case report.—An apprentice seaman, 24 years of age, with no previous history of venereal disease, developed a urethral discharge on 30 March 1945 after exposure 1 week previously. A urethral smear was positive for gram-negative intracellular diplococci. Sulfathiazole therapy was begun on 31 March in the usual dosage and the patient was allowed to remain ambulatory and on duty. On 10 April the urethral discharge was still profuse and gram-negative intracellular diplococci were present in the smear.

On this day penicillin sodium, 100,000 Oxford units, was given intramuscularly in the buttocks in doses of 10,000 units every 2 hours. The penicillin therapy was started at 0600. At 0900 the patient developed redness and rather intense itching of the palms of the hands. Two days later he complained of pain in the right knee and left ankle on walking. He was placed in bed and the evening temperature was 102° F. The right knee was red and slightly swollen with no evidence of suppuration into the joint space. The left ankle was slightly red but there was no swelling present. Thereafter the temperature continued to be elevated each evening, usually around 100° F., except on 18 April at which time it was 102.4° F. After that the afternoon temperature remained elevated around 100° F. for 2 more days and then became normal and remained so. Heart sounds remained normal throughout the illness. The white blood cell count was 10,500 and the differential was within normal limits. Recovery was uneventful and the patient was discharged on 23 April.

The patient's family history was negative for allergic diseases. In the past history the patient revealed that he had had one attack of "hay fever" 8 years previously while working on a combine, cutting grain that had a good deal of rust fungus. Since then he would sneeze and wheeze some when he went near barns or similar dusty places but has had no other allergic manifestations.

This case is somewhat similar to the one reported by Hailey and Millard.[1] The onset of an arthritis, that at first made one think of a gonoccocal complication of the knee, 2 days after receiving penicillin therapy, and a skin rash on the palms, with fever persisting for 8 days, leave this type of reaction open to question as to causative factors and

[1] HAILEY, H. E., and MILLARD, E. B.: Foreign protein reaction from penicillin. U. S. Nav. M. Bull. 44 : 207, January 1945.

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possible allergy with Puccinia graminis. Facilities were not at hand to make further investigation at this activity.

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METHOD FOR EVACUATION OF STRETCHER CASES IN ABANDONING SMALL SHIPS

Proper care and handling of stretcher cases presents a problem to the medical officer when it becomes necessary to abandon ship. On a large Naval vessel which is equipped with sizable lifeboats or landing craft, the wounded may be lowered over the side in these. Such is not the case on an LCM, LCI, and other small vessels. Their lifeboats are too small to accommodate a Stokes stretcher and the boat's crew. Life rafts, being cast overboard, are not suitable for lowering of wounded.

However, a man attired in his kapok life jacket and lashed in a Stokes stretcher will float safely, the bulk of the jacket holding the head and shoulders upward. Moderate rotation of the stretcher on its long axis causes little if any immersion of the face, because of the angle to the surface. In order to increase this angle, a 10- to 15-pound weight was secured within the foot of the stretcher. This resulted in a riding angle of 70 to 90 degrees, with longitudinal rotation by heavy sea causing no submersion of the face.

The additional load of the stretcher, about 22 pounds, and the foot weight, appear to have little effect on the bouyant efficiency of the jacket. It is all-important to lash the standard crotch straps of the jacket tightly in order to prevent it from riding up.

The horizontal position was tried by attaching another jacket to the foot of the stretcher, but this resulted in a dangerous lowering of the head. Jennings and Shelesnyak[1] have attached canvas-covered inner tubes to a Stokes stretcher for rescue work. Hall[2] has suggested that cork rings, a small air tank, or an inflatable tube be placed at the head of the stretcher to provide buoyancy in the event that the patient and stretcher are dropped into a heavy sea during transfer to small craft alongside.

In addition to the increased stability and safety of the almost vertical position, negligible previous planning or accessory material is needed. Floats permanently attached to the stretcher would impair its efficiency in manipulation through small hatches and passageways.—RHODE, C. M., Lieutenant (MC) U. S. N. R.

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[1] JENNINGS, B. E., and SHELESNYAK, M. C.: Improvised Stokes stretcher floats for air/sea rescue. Research Project, Naval Medical Research Institute, National Naval Medical Medical Center, 5 December 1944.

[2] HALL, G.: Floating Stokes stretcher. Hosp. Corps Quart. 18: 70, January 1945.

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FULMINATING SEPTICEMIA DUE TO STAPHYLOCOCCUS EPIDERMIDIS

REPORT OF A CASE WITH AUTOPSY FINDINGS

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HERMAN B. WILLIFORD
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and
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The occasional ability of staphylococci to produce septicemia has long been ascribed to the Staphylococcus aureus, the most potent pathogen of the genus staphylococcus. The albus strains of staphylococcus are considered to be of feeble pathogenicity and of little importance other than in mild suppurative conditions of the skin.

The existence of a species producing a porcelain white color, yet distinct from the recognized Staphylococcus albus was first described by Welch (*1*) in 1891 and named Staph. epidermidis albus. The same organism was isolated by Gordon in 1903. It is described in more recent literature under the name of Staph. epidermidis by Bergey (*2*), by Kolmer and Boerner (*3*) and by Topley and Wilson (*4*).

Since this genus is agreed to be of feeble pathogenicity and a habitant of normal skin, it is considered of interest to report here a fatal case of sepsis, with multiple brain abscesses, which was encountered recently in which the offending organism was proved to be the usually innocuous Staphylococcus epidermidis.

Case report.—A 20-year-old aviation cadet was transferred to the U. S. Naval Hospital at Corpus Christi, Tex., in a comatose state at 1230 on 12 March 1945, with a tentative diagnosis of septicemia. He had been admitted to the sick list at an Auxiliary Air Station 4 days earlier for observation of aching pain in the muscles of both legs, which he attributed to flying in rough air. Later that same day the pain had progressed to his back and arms, but there had been no objective findings other than a temperature of 102.6° F., and a mild localizing cellulitis surrounding a "corn" on the dorsum of the fourth toe, left foot. He had been receiving hot soaks to the infected toe for 2 days prior to his dispensary admission.

On the following day (9 March) the temperature rose to 105.2° F., and the white blood cell count to 24,500, with a differential ratio of 90 percent polymorphonuclear leukocytes, and 10 percent lymphocytes. Despite the paucity of

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physical findings, he received 20,000 units of penicillin every 3 hours by intramuscular injection because of the hyperpyrexia. The clavus was then opened by a surgeon, but no exudate was found.

On 10 March the temperature had dropped to 102.6° F., and the patient felt much better and appeared improved. He continued to complain of mild backache but there was no muscle tenderness. The penicillin was continued. In spite of intensive chemotherapy, his condition became progressively worse the following day. During the late afternoon of 11 March he showed signs of increasing toxemia accompanied by the appearance of hemorrhagic petechiae in the skin of the extremities.

On the morning of 12 March he received intravenously 1,000 cc. of 5-percent dextrose in saline solution. The diagnosis was changed from catarrhal fever to diagnosis undetermined (septicemia), and he was transferred to this hospital as an emergency case.

On admission to the hospital he was immediately placed on the critical list, as he appeared extremely toxic and dehydrated. He was stuporous and irrational and unable to respond to questioning. There was marked rigidity of the neck, and Kernig's sign was strongly positive. Multiple petechiae were scattered over the entire body, being especially prominent in the skin of the fingers, toes, palms, and soles. Smaller petechial hemorrhages were noted over the chest, abdomen, and back. The ocular fundi could not be visualized and nystagmoid movement of the eyeballs could not be established because of the patient's inability to cooperate. Hemorrhagic crusts were present in both nostrils; the tongue was very dry and swollen, the lips parched and crusted. The pharynx could not be visualized. There was no cervical lymphadenopathy.

The lungs were entirely clear to percussion and auscultation. The heart was not enlarged and no cardiac murmur was elicited. The pulse rate was 112; blood pressure was 160/85. Definite cyanosis was noted in the nail beds. The liver and spleen were not palpable. There were no abdominal scars or hernias. The superficial reflexes were absent. The genitalia were normal. Rectal examination was not done. The extremities presented extensive petechial hemorrhages as noted above. There was no muscle atrophy. On the fourth toe of the left foot was located a shallow clavus which was not infected at the time of the hospital admission. The temperature was 102.6° F. by axilla. The tentative clinical impression was meningococcic meningitis with meningo-coccemia.

On admission at 1330, spinal puncture was performed by a neurosurgeon who noted a right hemiparesis but found no facial asymmetry. The spinal fluid was under increased pressure (510 mm. of water) but presented both circulatory and respiratory pulsations. The serosanguineous fluid contained 2,200 leukocytes per cubic millimeter (96 percent segmented forms and 4 percent large lymphocytes). The blood count was 3,700,000 erythrocytes, hemoglobin concentration 11 grams, and leukocytes 12,000, having 2 percent band forms, 82 percent segmented cells, 14 percent lymphocytes, 1 percent basophils, and 1 percent monocytes.

As soon as a blood culture was taken, the patient received 1,000 cc. of 5-percent dextrose in saline solution followed by 5 grams of sodium sulfadiazine intravenously. Further intravenous fluids were contraindicated because of the increased intracranial pressure. He was therefore started on 1,000 cc. of Ringer's solution by hypodermoclysis, placed in an oxygen tent and given 40,000 units of penicillin intramuscularly every 3 hours.

At 2000 that evening the temperature was 106.8° F. by axilla, the pulse rate 120, and respirations were 32 per minute. He was deeply comatose. Spinal puncture was repeated. The initial pressure was greater than 600 mm. of water; the spinal fluid rose above the top of the manometer. Normal cardiac and

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respiratory excursions were again noted. Thirty cubic centimeters of grayish-pink fluid was allowed to escape slowly, reducing the intraspinal fluid pressure to 250 mm. of water. Forty thousand units of penicillin in 10 cc. of physiologic saline solution were introduced intrathecally, and 5 grams of sodium sulfadiazine in 20 cc. of saline solution was again administered intravenously. The second specimen of spinal fluid showed 16,842 erythrocytes and 6,789 leukocytes per cubic millimeter, with 72 percent segmented cells and 28 percent lymphocytes. Gram-positive extracellular diplococci were found in the stained smear.

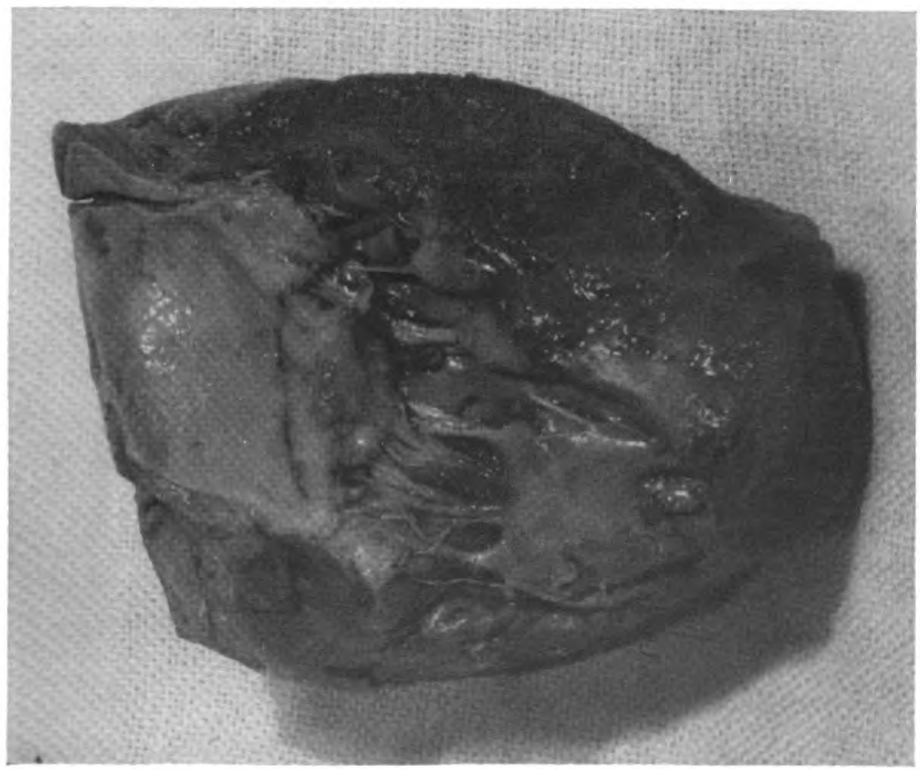
The blood sedimentation rate was but slightly elevated (11 mm. in 60 minutes). x-ray examination of the chest was inconclusive, routine Kahn test was negative, and culture of throat scrapings yielded no pathogens. Urinalysis was not done because the patient was incontinent.

At 2200 the temperature was 107.6° F. by axilla, the pulse rate 160, respirations were 36, and blood pressure was 120/60. The patient became restless but at no time had convulsive seizures.

At 2300, in spite of all supportive measures, the terminal hyperpyrexia reached 110° F. by axillary thermometer, and the pulse rate 180 beats per minute. The sonorous respirations became stertorous, and the patient expired at 2330 on 12 March, 11 hours after admission to the hospital.

The clinical diagnoses at the time of death were (1) septicemia (cause undetermined), and (2) meningitis (cause undetermined).

Complete postmortem examination was performed 12 hours after death. Because the pathologist's findings are of special interest in this case, his notes are quoted.



1. Vegetations on mitral valve caused by Staphylococcus epidermidis in a case of fulminating septicemia.

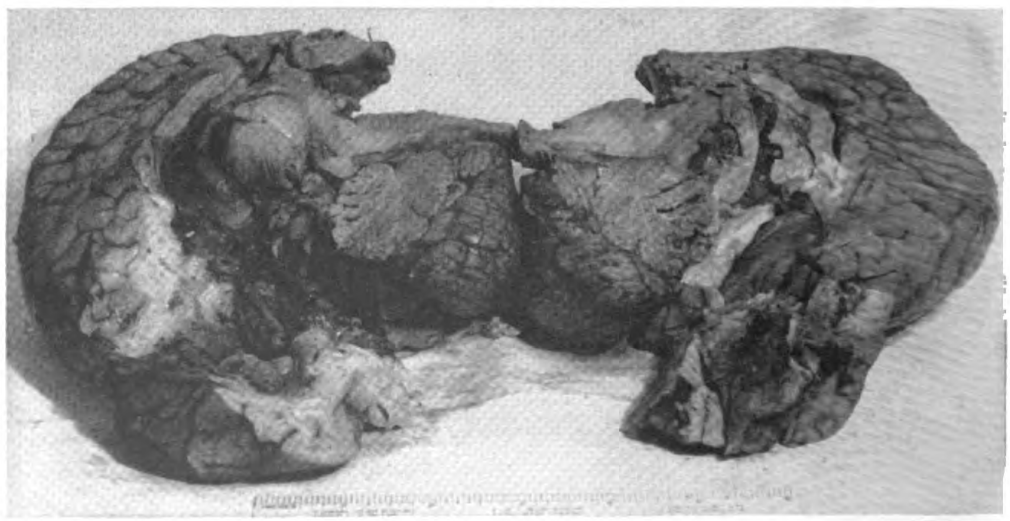
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Necropsy report.—The body was that of a well nourished, muscular, white male. Petechiae of the skin were present as described in clinical notes. The lower lobe of the left lung showed evidence of hemorrhagic consolidation. The left side of the chest cavity contained 1,500 cc. of blackish, watery fluid. The right lung showed hypostatic congestion. The right chest cavity contained 100 cc. of straw-colored fluid. The heart was larger than normal, its musculature was pale, and the visceral pericardium showed many petechiae. The coronary arteries were patent. The posterior cusp of the mitral valve contained a dull brown crumbly vegetation involving the midapposition site for 1 cm. (fig. 1).

There was a 2-cm. hole in the stomach at the junction of the middle and lower thirds, immediately posterior to the greater curvature. The pancreas, spleen, visceral peritoneum, left adrenal gland, and the diaphragm were involved in a digestive degeneration. The left side of the diaphragm was perforated by this digestive process, in the midanterior site, permitting fluid content from the stomach to enter the left chest cavity. Margins of the gastric opening were pale, not congested, and resulted from postmortem digestion.

The spleen was twice normal size, soft and pale. The liver was of normal size, the capsule smooth and yellowish in cut section. Both kidneys were glistening and edematous with pechial hemorrhagic infiltration over the capsules. The cut section was congested and rolled outward. The bladder and prostate were grossly normal. The jejunum and ileum had small sites of hermorrhagic infiltration opposite the mesenteric attachment, which lesions on gross section were found to be small blood clots within the intestinal musculature. Both adrenal glands appeared to be moderately congested.

In the head, transverse scalp and V-type calvarium incisions were found. The meningeal vessels of the brain were congested, the cerebral gyri flattened. The left cerebral hemisphere showed a central malacia involving the anterior two-thirds of the occipital lobe and the posterior one-third of the parietal lobe. Fresh blood clot filled the remaining mid- and anterior portions of the left lateral ventricle. The right cerebral hemisphere contained an organized blood clot, 3 cm. in diameter, with malacia of adjacent brain structure in the occipital lobe. The right lateral ventricle contained fresh blood (fig. 2).



2. Multiple hemorrhages and embolic brain abscesses due to the Staphylococcus epidermidis in a case of fulminating septicemia.

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Direct smears from the lesions of the brain, from the mitral vegetations and from the emboli of the intestinal musculature demonstrated gram-positive cocci, many of which appeared as diplococci.

Microscopic sections showed the vessels of the lung tissue to be generally congested. The alveolar walls were ruptured at the sites of hemorrhagic consolidation. The heart muscle was mildly edematous and exhibited small round-cell infiltration with occasional polymorphonuclear cell invasion. The mitral vegetations comprised solid masses of cocci involving an edematous fibrous structure. The spleen showed diffuse polymorphonuclear cells, a few eosinophils, nuclear fragmentation, and moderate pigmentation. The capsule, supporting reticulum, and the splenic corpuscles showed no evidence of hyperplasia. The liver revealed small round and pus cell infiltration, more commonly about the central veins and occasionally involving the portal sites. There was increased pigmentation of the liver cells with toxic edema and interstitial edema.

Sections through the kidneys showed areas of vascular congestion, mostly about the tubular structure. There was a rare microscopic embolic site, containing clumps of bacteria (cocci) about which early fibroblastic reaction predominated. The cells lining the tubules varied from cloudy swelling to hydropic degeneration. A few small round cells and polymorphonuclear leukocytes were noted irregularly through the glomerular tufts.

The adrenal glands exhibited moderate vascular congestion immediately subcapsular. No emboli and necrosis were noted, and no evidence of hemorrhage in the cortex or medulla. Microscopic sections through the brain revealed many bacterial embolic sites, multiple areas of blood extravasation, and massive anemic necrosis of brain substance. The vessels were greatly congested but not occluded. The ependymal structure showed areas of small monocytic cell infiltration and evidence of edema.

The anatomic diagnosis was endocarditis, mitral valve of the heart (staphylococci); multiple emboli and massive malacia of the brain with multiple hemorrhages; embolic and toxic necrosis of the liver; embolic, hemorrhagic, and hydropic necrosis of the kidneys; hemorrhagic, embolic sites, intestinal musculature; hemorrhagic congestion, lower lobe left lung; acute splenic tumor, gray type; acute congestion of the adrenal glands, early; and myocarditis, acute, early.

Smears from brain abscesses, intestinal embolic sites, and mitral valve vegetations showed gram-positive cocci, usually in pairs, sometimes in clusters. Cultures from this necropsy material produced growth of an identical organism isolated from the spinal fluid and blood cultures taken before death and later identified as Staphylococcus epidermidis. Cultural characteristics, identical from the five sources, are given for diagnostic purposes. The organism appears in tissue as fairly large gram-positive diplococci; in artificial cultural media as slightly smaller gram-positive cocci in clusters. On plain agar the colony is small, white and translucent. Gelatin is liquefied after 48 hours; blood agar shows narrow zone of hemolysis after 48 hours. Litmus milk is acid with no coagulation; growth on potato is white and very scant; indol is not formed. Broth is turbid with white ring and sediment. Acid but no gas is produced on dextrose (lactose, sucrose, maltose and levulose). No acid or gas is produced on inulin or mannitol. Coagulase test is positive at the end of one hour. This organism is differentiated from "albus" by its less active gelatin liquefaction and blood hemolysis, by scant growth on nutrient agar and potato, absence of coagulation of milk, and its fermentation reactions on levulose and mannitol. Variations of temperature, light, and culture-age failed to produce pigment.

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COMMENT

In retrospect, it is evident that the patient succumbed to an overwhelming septicemia due to the Staphylococcus epidermidis, with vegetative endocarditis of the mitral valve, and embolic brain abscesses with rupture into the cisterna and subsequent ependymitis. Embolic phenomena were also noted in the liver, intestines, and kidneys.

It is interesting to speculate on the probable portal of entry of the offending pathogen. Could the organism have gained entrance to the blood stream through the infected clavus on the fourth toe, left foot? A mild cellulitis of contiguous tissue of this toe was noted at the time of the patient's admission to the sick list 4 days before death. Moreover he had received treatment for this infected "corn" as an ambulatory patient in the dispensary of the Auxiliary Air Station 2 days prior to 8 March 1945. Furthermore it has recently been ascertained from his friends and classmates that the patient had "not been feeling well" for a week or 10 days previous to his admission to the sick list. He exercised violently in the gymnasium for several hours a day in an effort to work out or "sweat out" his indisposition. He did not report to sick call for fear of being turned in as a patient. He was afraid that being in the sickbay might prevent his "winning his wings" and graduating with his class. One result of his voluntary strenuous athletic program may have been the infection of the toe. This in turn may have led to the fulminating septicemia and death.

SUMMARY

A case of fulminating septicemia due to Staphylococcus epidermidis is reported. This species of organism is a skin contaminant and usually is quite innocuous or only mildly pathogenic. In our patient the portal of entry to the blood stream may have been an abraded or infected clavus on the fourth toe of the left foot. The apparent duration of the fulminating septicemia was not over 5 or 6 days. Clinically, in the terminal phase, the case resembled meningococcic meningitis with meningococcemia. Differential diagnosis was established by bacteriologic study of blood and spinal fluid cultures taken before death and by smear and culture of the lesions in the heart, brain, and intestine at necropsy, all of which yielded a pure growth of Staphylococcus epidermidis.

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3. KOLMER, J. A., and BOERNER, F.: Approved Laboratory Technic. 3d edition. D. Appleton-Century Company, Inc., New York, 1941. p. 442 and p. 486.
4. TOPLEY, W. W. C., and WILSON, G. S.: The Principles of Bacteriology and Immunity. 2d edition. Wm. Wood & Company, Baltimore, 1941. p. 481.

REPEATED THORACENTESIS IN PNEUMOTHORAX

The effectiveness of repeated thoracentesis in the treatment of 225 patients with hemothorax is apparent in the incidence of infection of only 16.8 percent, as compared to an incidence of infection of 45.9 percent in 74 patients not aspirated.

Early thoracotomies employed in the treatment of chest injuries designed to stop hemorrhage or to prevent infection have frequently been followed by these as complications. This is particularly apt to be true if the chest is closed without drainage. Of the 156 initial thoracotomies, 48.7 percent were complicated by an infected hemothorax, 30 percent by a hemothorax, and 6 percent by an organized hemothorax. The operative group includes the more severe injuries and the likelihood of complications is greater, but it also includes a number of patients that could have been treated as well by conservative means—KAY, E. B., and MEADE, R. H., JR.: War injuries of chest. Surg., Gynec. & Obst. 82: 13–24, January 1946.

EXPERIMENTAL PREVENTION OF "PEPTIC ULCER"

Evidence from studies on Mann-Williamson dogs, which consistently develop postoperative jejunal ulcer, shows that the daily parenteral administration of an intestinal extract, concentrated in regard to enterogastrone, prevents ulcer from developing in approximately 80 percent of the dogs. When the therapy is discontinued after several months, the animals are resistant to the occurrence of ulcer for periods of from 18 to 46 months. It has been demonstrated also that a relatively crude extract of intestinal mucosa is orally effective in preventing ulcer in M–W dogs.—IVY, A. C.: Potential physiological contribution to prevention of "peptic ulcer" in man. Federation Proc. 4: 222–225, September 1945.

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MENINGOCOCCAL CONJUNCTIVITIS

REPORT OF A CASE

FRANK B. HAYS
Lieutenant (MC) U. S. N. R.
and
RODNEY D. CHAMBERLAIN
Commander (MC) U. S. N.

The following case is presented because of rare occurrence as recorded in medical literature. Duke-Elder (*1*) states: "Occasionally an exogenous meningococcal infection occurs with general symptoms; as an exceptional event meningitis has followed the conjunctival infection, the sequence suggesting that the organism had found a portal of entry to the system in the conjunctiva." Reid and Bronstein (*2*), and Clifton and Laird (*3*) point out the fallacy of presuming a diagnosis of gonococcal conjunctivitis when intracellular and extracellular gram-negative diplococci are found in a conjunctival smear. They caution that detailed bacteriologic and serologic studies should be made.

A survey of recent literature reveals reports of several cases of meningococcal conjunctivitis, but in only six cases did the development of conjunctivitis precede the systemic manifestations of meningitis (*1*) (*2*) (*3*) (*4*).

Case report.—A seaman, second class, 19 years of age, reported to the sickbay complaining of pain, photophobia, and purulent discharge in his right eye of 12 hours' duration. Examination of the eyes revealed no abnormality except for a profuse purulent discharge from the right eye, with considerable conjunctival injection and edema of the lids.

He received boric acid eyewashes and application of butyn and metaphen ointment. A smear made for diagnosis contained intracellular and extracellular gram-negative diplococci. The patient vigorously denied any genito-urinary manifestation of gonorrhea or any contact with a possible source of infection.

While awaiting definite diagnostic data from the laboratory, the patient began to vomit almost constantly and became semicomatose. Physical examination revealed the temperature to be 100° F., the pulse rate 68, and respirations 46 per minute. The neck was rigid. Deep reflexes were hyperactive. Kernig's sign was positive and Babinski's sign was negative. The clinical picture was that of a fulminating cerebrospinal meningitis. Spinal puncture done at this time revealed purulent fluid under increased pressure. The cell count was 14,000

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per cu. mm. and a culture of the fluid was made. Before removal of the spinal needle, 10,000 units of penicillin in 10 cc. of normal saline solution were injected. Intravenous injection of 50,000 units of penicillin in 1,000 cc. of physiologic saline solution was started. Culture of the discharge from the right eye was made. The right eye was irrigated with boric acid, followed by instillation of penicillin solution (concentration 500 units per cc.).

The following treatment regimen was instituted. Irrigation of the eye was followed by instillation of 3 or 4 drops of penicillin solution (concentration 500 units per cc.) every 2 hours. Intramuscular injection of 20,000 units of penicillin was made every 4 hours. Spinal puncture followed by injection of 10,000 units of penicillin in 10 cc. of physiologic saline solution was done every 12 hours. (The patient's health record revealed hospital admission 8 months previously for dermatitis medicamentosa as a result of medication received during an antistreptococcus program; hence sulfonamide drugs could not be used.)

Twenty-four hours later there was evidence of slight improvement in his general condition, with a decrease in the respiratory rate and an increase in the pulse rate. The patient was still semicomatose and vomiting frequently.

Examination of the right eye showed the conjunctiva and eyelids to be inflamed and there was a purulent discharge. The cornea was dull and grayish and there was a catarrhal ulcer. No estimate of visual acuity was possible. Treatment was supplemented with intravenous injection of 50,000 units of penicillin in 1,000 cc. of physiologic saline solution.

Forty-eight hours later there was marked improvement in the general condition. The temperature was 100° F. by rectum, the pulse rate was 64, and respirations were 28 per minute. The patient was alert and rational. Examination of the right eye showed some inflammation of the conjunctiva. The cornea was clearing and the ulcer had decreased in size. Vomiting was diminishing.

Seventy-two hours later the patient showed continuous improvement. He moved about freely, he was eating, and vomiting had ceased. Examination of the right eye revealed resolution of the ulcer with little residual clouding of the cornea. Vision was slightly blurred.

Four days later the patient's general condition was good. His temperature was 98.6° F., the pulse rate was 72 and respirations were 22 per minute. He was sitting up and eating well. The cornea was healed and clear. On the upper lip there was a cluster of herpetic lesions which were secondarily infected. These were treated with compresses soaked in penicillin solution (concentration 500 units per cubic centimeter) with excellent results.

Eight days later the patient was ambulatory and there were no residual signs of the conjunctivitis or meningitis. Cultures and agglutination tests of spinal fluid and of the discharge from the eye were reported to contain meningococcus, type I. The patient had received a total of 940,000 unit of penicillin over a period of 5 days as follows: 40,000 units intrathecally, 140,000 units intravenously, and 760,000 units intramuscularly.

CONCLUSION

In cases of purulent conjunctivitis showing gram-negative intracellular and extracellular diplococci on smear, without obvious source of infection, bacteriologic and serologic studies should be made promptly to insure correct diagnosis and institution of adequate therapy.

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The effect of penicillin in the treatment of local and systemic manifestations of meningitis is demonstrated.

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PENICILLIN IN THE TREATMENT OF TETANUS

Two cases of severe tetanus are reported in which recovery followed treatment with large amounts of antitoxin, surgical excision of the wounds, and administration of large doses of penicillin.

Bacteriologic studies revealed that Clostridium tetani could no longer be isolated from the wounds in these patients 24 hours after the first administration of penicillin. The already demonstrated antibiotic influence of penicillin on this organism in vitro therefore appears to be confirmed in vivo.

The use of penicillin in tetanus appears to be most valuable in cases in which multiple lesions, not all of which can be removed by surgical means, are present or in which no focus of infection is detectable. This antibiotic agent is not intended to replace the administration of antitoxin, excision of wounds, adequate sedation and maintenance of a normal state of nutrition and hydration, but appears to be a highly important adjuvant to these other therapeutic measures.—WEINSTEIN, L., and WESSELHOEFT, C.: Penicillin in treatment of tetanus. New England J. Med. 233: 681–684, December 6, 1945.

SULFANILYL BENZAMIDE IN TREATMENT OF BACILLARY DYSENTERY

Twenty-one patients with bacillary dysentery were treated with sulfanilyl benzamide; 16 were bacteriologically positive.

The total dose required was only 14 grams (28 tablets) for complete cure, except in two patients with Shiga infection who required a little longer treatment. Almost all the patients were fit to resume work within 5 days. Stool culture was done up to 3 months with negative results in all cases. No relapse was seen in a period of 6 months' observation. The drug was found to be nontoxic.—BOSE, A. N., and GHOSH, J. K.: Sulphanilyl benzamide in treatment of bacillary dysentery. Indian M. Gaz. 80: 293–294, June 1945.

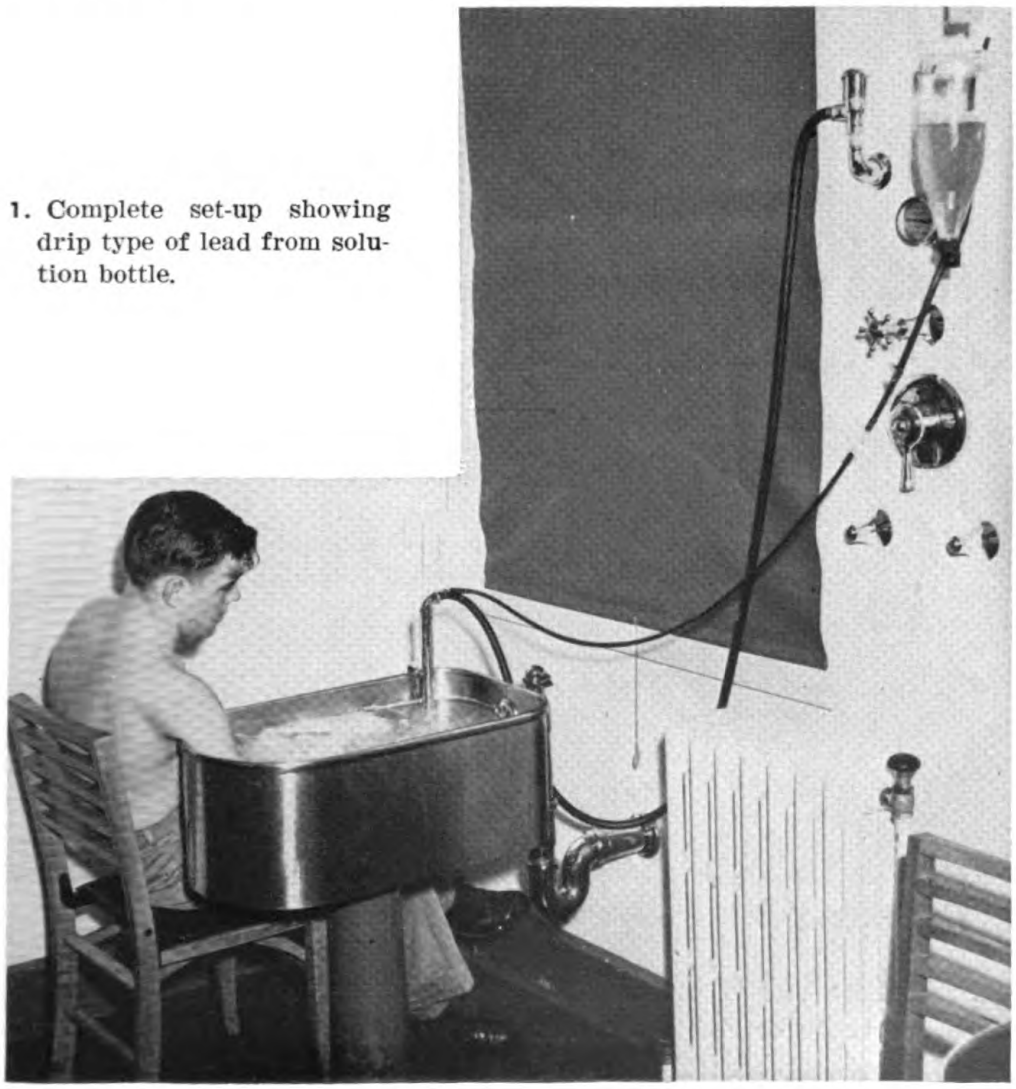
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MEDICAL AND SURGICAL DEVICES

METHOD FOR PRODUCING SOAPY SOLUTION IN WHIRLPOOL TANK

LOUIS B. NEWMAN
Commander (MC) U. S. N. R.

In the treatment of open wounds with hydrotherapy, the wounds are thoroughly and continuously bathed in warm soapy water. The soapy solution is used not only for its mild antiseptic effect, but also



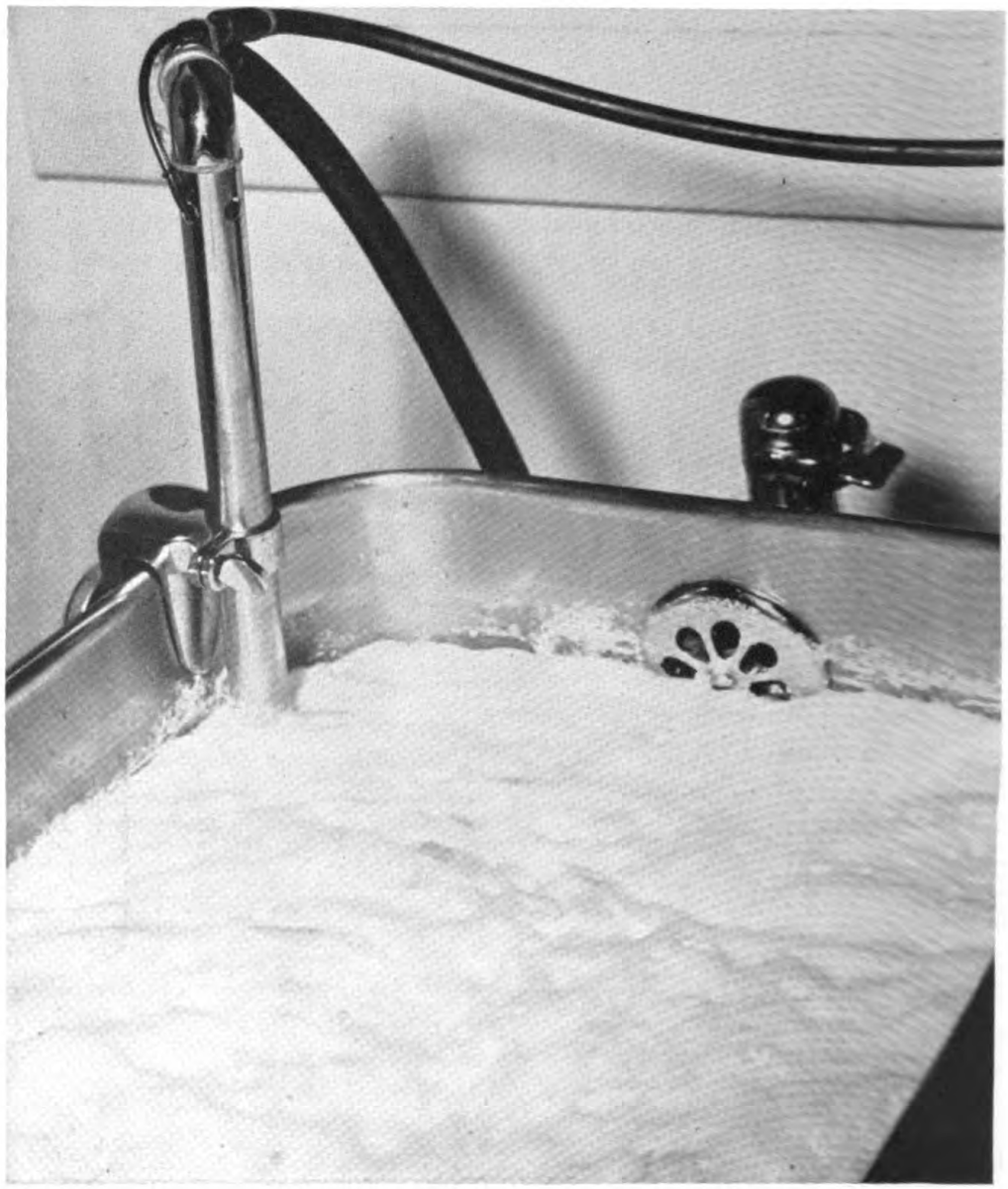
1. Complete set-up showing drip type of lead from solution bottle.

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for its thorough cleansing effect, which is enhanced by the water being warm (temperature 110° to 115° F.) and continuously agitated.

A simple procedure to secure a uniform soapy solution in the whirlpool tank is as shown in figures 1 and 2. A discarded intravenous flask is filled with liquid soap and suspended above the tank. The soap is permitted to drip through a small piece of rubber tubing or



2. The soap solution tube (catheter) is shown inserted in air intake.

catheter into one of the air intake openings, so that the soap mixes with the water and air at the outlet of the nozzle in the tank. The quantity of soap is controlled by the screw clamp on the rubber tubing. A very copious soapy solution can be secured.

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In the whirlpool tanks which have a motor-driven water agitator, the end of the rubber tubing can be placed in the tank, the end of the tubing being weighted down by any small rust-proof weight. This weight keeps the tubing on the bottom of the tank.

Another simple method for producing a soapy solution in the whirlpool tank is to suspend in the tank an ordinary popcorn popper filled with bar soap. The agitating effect of the whirling water will produce a satisfactory soapy solution.



PROGRESS IN TREATMENT OF SUBACUTE BACTERIAL ENDOCARDITIS

Three hundred and forty-seven proved cases of subacute bacterial endocarditis treated at the Peter Bent Brigham Hospital from 1913 to 1945 were studied. There were no known recoveries among 237 cases seen between 1913 and 1937, during which time a great variety of therapeutic procedures was employed.

Of the 90 cases observed from 1937 to 1943, 55 received adequate treatment with a sulfonamide. Sixteen of the latter patients were given simultaneous fever therapy. Of these, one treated by infra-red radiation and three treated by typhoid vaccine recovered and have remained well for from 2 to 4 years. None of the other sulfonamide-treated patients recovered.

Of 20 patients studied since January 1944, 17 were given large doses of penicillin. In 11 cases the infection has been cured or arrested and the patients are now alive. The follow-up periods vary between 6 and 18 months. In two others the infection was bacteriologically arrested but death occurred some weeks later because of complications.—FAVOUR, C. B.; JANEWAY, C. A.; GIBSON, J. G.; and LEVINE, S. A.: Progress in treatment of subacute bacterial endocarditis. New England J. Med. 234: 71–77, January 17, 1946.



FACTORS OF HEREDITY

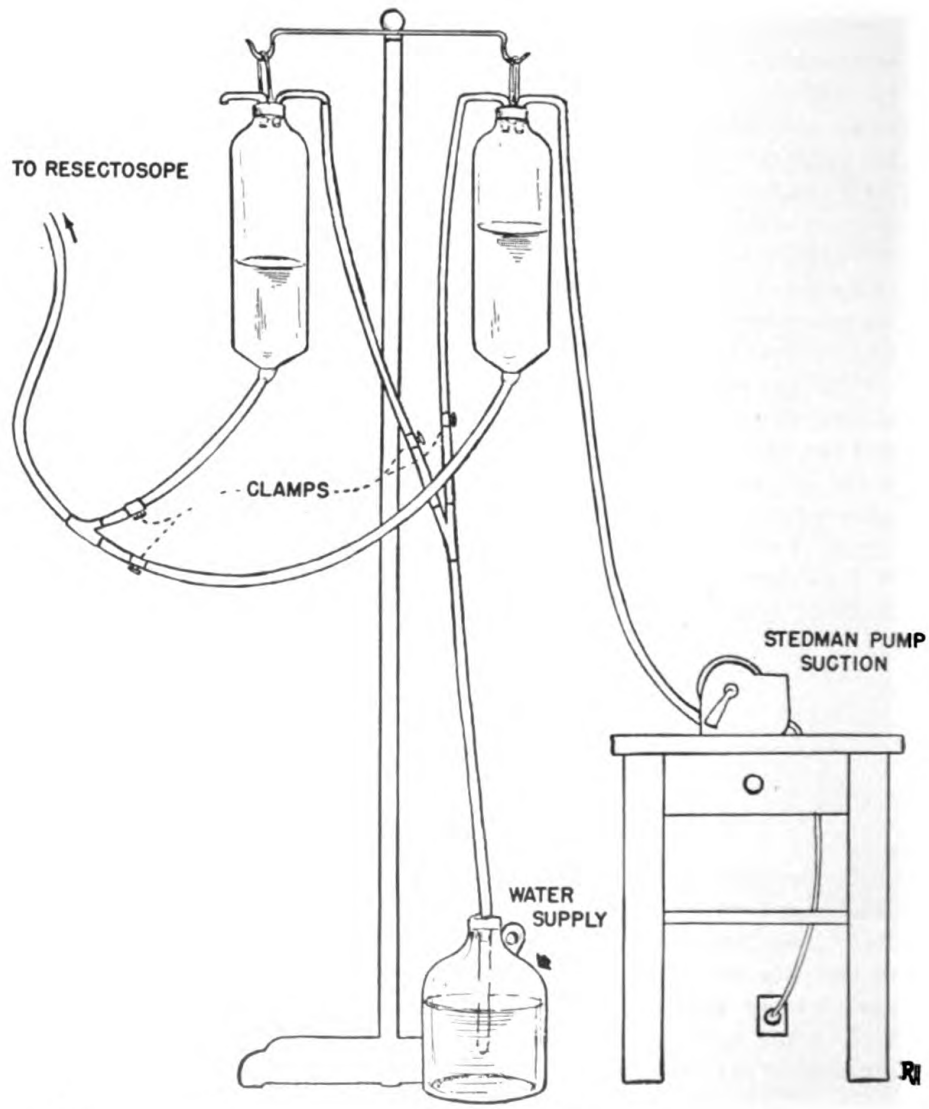
Factors of heredity determine conditions of health as well as some malformations, diseases and predispositions to disease. Such heredity is inflexible in certain traits, but for many traits the mechanisms of heredity are labile. Hereditarily prospective traits may be either sustained or altered by environmental influences, which are effective on the sperm and egg, and on the individual from the very beginning of his existence as an embryo.—CUMMINS, H.: Some principles of genetics. New Orleans M. & S. J. 98: 252–261, December 1945.

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IRRIGATION APPARATUS FOR RESECTIONS

LOWELL RHODES
Pharmacist's Mate, second class, U. S. N. R.

The purpose of this paper is to introduce a new type irrigator for use in transurethral prostate resections. This apparatus has been in use with a greal deal of satisfaction in the urological department at the U. S. Naval Hospital, Shoemaker, California.



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In the old irrigator, air bubbles entered the operating field when new water was added to the flask. Air bubbles by this method are eliminated. There is also no chance for contamination of the water supply.

The irrigating apparatus, as outlined in the accompanying drawing, consists of: One stand, of adjustable height (to allow variation in amount of pressure on water used); two graduated flasks; two connecting tubes for water from flasks joined by a Y tube, for water to instruments; two connecting tubes, joined by Y tube, to supply flasks with water from the water supply; each water supply tube has one clamp; four U tubes; and one Stedman suction pump.

To fill the flasks, close all clamps except the one that goes to the water supply on side to be filled, connect suction tube, and turn on the suction pump. When the flask is filled, the water supply is clamped off and the suction tube is removed.

The use of the apparatus is very simple. When in use, allow only one flask to be used at a time. When it is empty, release clamp on tube of unused flask, close clamp on empty flask, hook suction tube to empty flask, turn on suction, and release clamp to water supply. This process goes on until the operation is completed.

Air vent tubes and flasks must remain open to allow operation of atmospheric pressure.

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THE PERIODICITY OF INFLUENZA

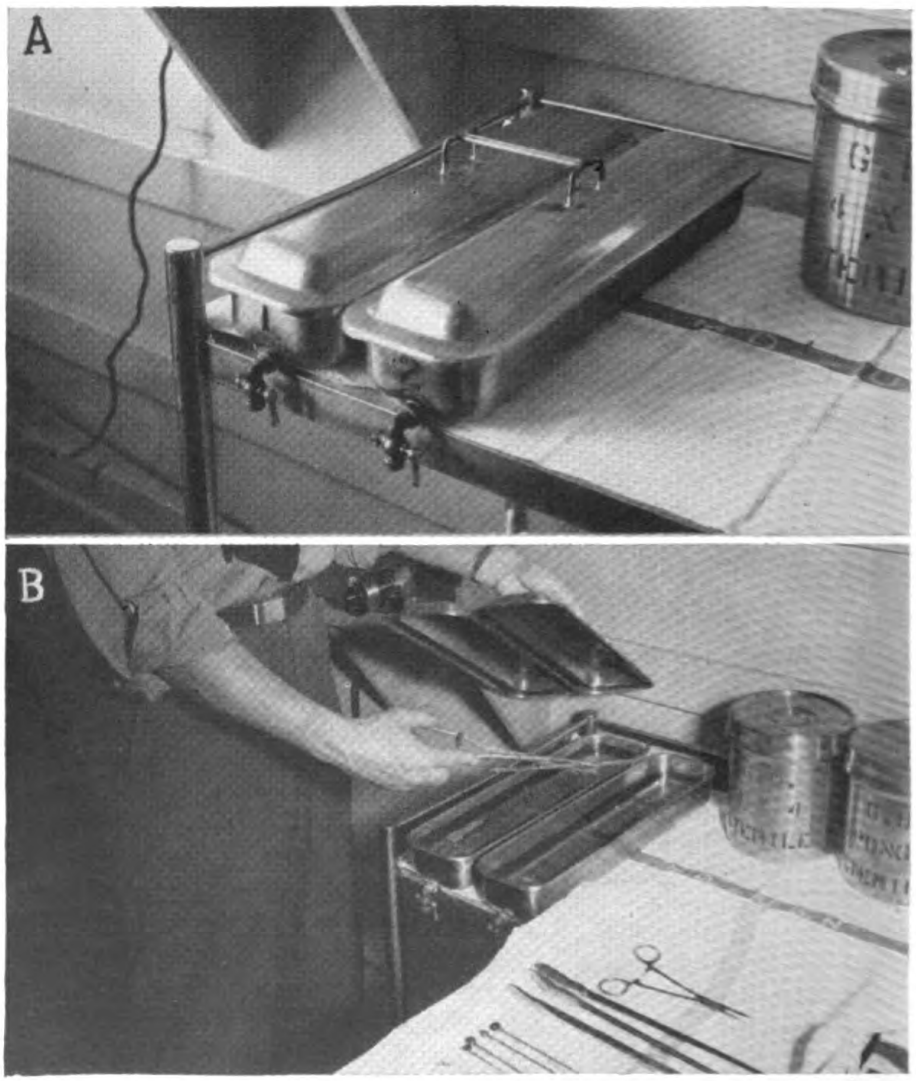
The 16 widespread epidemics of influenza which have occurred in the United States between 1920 and 1944 can be accounted for on the basis of two specific recurrent infections. Influenza A appears to have a cycle of 2 to 3 years and influenza B a cycle of 4 to 6 years. There is no indication that other influenza viruses have caused widespread epidemics in this country during the past 25 years. On the basis of this formulation, the probability of occurrence of future epidemics within certain time limits has been forecast. It has been suggested that the balance between immune and susceptible individuals in the population is the dominant factor which determines the occurrence of influenza epidemics.—The Commission on Acute Respiratory Diseases, Fort Bragg, North Carolina. Am. J. Hyg. 43: 29–37, January 1946.

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A SIMPLE TYPE OF IMMERSION STERILIZER

GEORGE L. WATKINS
Lieutenant (MC) U. S. N. R.

It is often desirable to rely on chemical sterilization of urologic instruments such as sounds, bougies, and certain types of catheters. A simple immersion sterilizer has been constructed from two stain-



1. (A) Immersion (chemical) sterilizer. (B) Transferring instruments from sterilizing to rinsing tray.

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less steel catheter trays. They are welded together at their bases by two 7- by 1-inch metal strips, so that their adjacent rims are ⅛ inch apart. The lid handles are removed, the two lid edges are welded together, and a single handle, molded from a large-gage steel wire, is welded in place (fig. 1A). A spigot is welded into the end of each tray for changing the solutions. With this arrangement both lids may be removed simultaneously, with the other hand free to transfer instruments from the sterilizing solution through the rinse (fig. 1B).

The main objection is the lack of depth, but when the ordinary commercial types of immersion sterilizers are not available it serves admirably.

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SUSCEPTIBILITY OF PHTHIRIUS PUBIS TO INFECTION WITH TYPHUS VIRUS

Three batches of laboratory-bred pubic lice fed on three typhus fever patients for from 7 to 9 days during the height of the disease were shown to be infectious, as demonstrated by guinea pig inoculations. The inoculated guinea pigs showed typical febrile reactions and not infrequently also scrotal swelling. Rickettsia prowazeki was demonstrable in scrapings as well as in tissue cultures of the inflamed tunica and in the gut of body lice inoculated rectally with the brain emulsion of infected guinea pigs.

In viewing of the prevalence of typhus fever and the not uncommon occurrence of phthiriasis in Peking, the positive feeding experiments reported here seem to suggest that under certain circumstances the pubic louse may act as a transmitter of typhus fever.—CHUNG, H. L.: On the susceptibility of Phthirius pubis to infection with typhus virus. Chinese M. J. **62**: 331–333, October-December 1944.

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NEW TYPE OF FILTER FOR DUST

An effective air-filter unit was constructed of two rectangular metal cages (apparently of expanded metal), one fitting coaxially within the other. The inlet to the filter passed straight into the inner cage. A three-jet mist projector was fitted inside, near the end of the inlet tube, to blow a very fine water mist into the filter. The 5-inch gap between the two cages was packed with coarse filter material (in this case ⅛ to 1 in., coal, though a variety of other materials could be used). The effective filtering area was 12 square feet and such a filter would be capable of dealing with about 3,000 cubic feet of air per minute with a back pressure of 2- to 3-inch water column. The efficiency of the filter when dealing with heavy dust clouds would be about 95 percent, and this increases as the back pressure increases.—GRIFFITHS, J. H.: New type of filter for dust work. Chem. Abstracts **39**: 5133, November 20, 1945.

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BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.
(For review)

RYPINS' MEDICAL LICENSURE EXAMINATIONS, Topical Summaries, Questions, and Answers, by *Walter L. Bierring, M. D., F. A. C. P., M. R. C. P., Edin.* (*Hon.*), *Member, National Board of Medical Examiners; with the collaboration of a review panel.* 5th enlarged edition, completely revised. 546 pages. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1945. Price $6.

Books of this type are monuments to the unfortunate State medical licensure situation in this country. That the perpetuation of a museum of questions aids in the qualifying of physicians to practice their profession is untenable—questions which demonstrate neither the ability of the examinee to practice medicine nor the examiner to pass judgment on the examinee. The problem is not clarified in the editor's own chapter, "The Philosophy of Examinations" appraised by the editor as "one of the outstanding features of the book."

A characteristic of this book, which its publishers consider an improvement on the usual question and answer type of presentation, is the arrangement of the factual material, i. e., the answers into concentrated sentences and paragraphs creating the semblance of chapters. The questions appear at the end of the so-called chapter. This has the worthy but unattained purpose of adding zest, and stimulation to the search for the answer by the jaded reader, and possibly a certain scientific veneer for the more fastidious. The result is a phenomenum of literary mechanics in which the obliging contributors have been required to begin at the end, the time honored questions, and arrange the answers into the fabric of sentences and paragraphs at the beginning.

The questions themselves are all they are advertised to be. They are time-tested by usage and frequency of occurrence, and properly difficult.

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The book accomplishes what it intends and will probably serve a useful purpose to that segment of the medical structure which may have need for it.

THE OSSEOUS SYSTEM, A Handbook of Roentgen Diagnosis by *Vincent W. Archer, M. D., Professor of Roentgenology, University of Virginia Department of Medicine.* 320 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1945. Price $5.50.

This handy volume embodies many features which tend to clarify, but not oversimplify, the diagnosis of traumatic and pathological bone lesions. Foremost of these features is the arrangement of the material based on the outstanding roentgen abnormality, e. g., bone destruction, bone formation, periosteal thickening, etc. There is a certain repetition of a diagnostic criteria for certain lesions falling into more than one of these categories but such repetition is the essence of good pedagogy. Also of great help to the medical officer who may lack full training in radiology is the listing of the projections required to bring out certain lesions not able to be diagnosed or even suspected by conventional views. Illustrations are good, though no reproduction of a radiograph can approach in value direct viewing of a film properly illuminated. The chapter bibliographies are comprehensive but recent.

The author's dedication of the book to the occasional radiographer is admirable but may be misleading, for the book demands careful reading and is not a short-cut to accurate roentgen diagnosis by the untrained; in fact, some of the factual material is so strikingly new that it surprises an old hand. In three places the author uses the term "malignant degeneration", referring to change in a previously benign lesion. This term is anathema to pathologists, for neoplasia is never primarily degenerative biologically.

This book is a fitting companion of Dr. Lorimer's "The Arthropathies". Bones *in vivo* (and their abnormalities) can scarcely be considered without a knowledge of the joints by which most of them are bounded.

AMERICAN PHARMACY. Fundamental Principles and Practices. Pharmaceutical Preparations. Biologicals. *Editor-in-Chief Rufus A. Lyman, M. D., Dean, College of Pharmacy; Director, Student Health Service, University of Nebraska; Editor, American Journal of Pharmaceutical Education. Seven associate advisory editors and 22 authors;* 540 pages; 197 illustrations; J. B. Lippincott Co., Philadelphia, Pennsylvania; 1945. Price $8.

This excellent book is in the nature of a compromise between a compend of pharmacy and a large voluminous textbook. It could properly be called an "Elements of Pharmacy." It is divided, like the famous division of Ceasar's Gaul, into three parts. The first, deals with the fundamental operations of pharmacy; the second and

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larger part, with pharmaceutical preparations; and the third, with the biologic materia medica.

Usually a book with composite authorshp is disjointed and uneven in character but that is not true of this work. Part of this is due to the fact that the subdivisions of pharmacy can be rather easily separated into monographs, and partly because each monograph here has been dealt with by a specialist who is an authority on his subject. This applies whether dealing with sections on the pharmaceutical process such as an extraction, or solution, or the sections on biologicals, or the official preparation. It must be remembered too, that much of the credit for the success of a book of multiple authorship should go to the editor who has here produced a smooth and well integrated work.

The title, "American Pharmacy", is of interest for standard American pharmaceutical processes have been followed throughout. The illustrations are particularly fine. I do not believe that those in Section 26 on powders, capslues and similar preparations can be matched in any pharmaceutical publication. The colored frontispiece is a reproduction on one of Dean Cornwell's finest paintings. Another feature and a very necessary one for a book of this character is the index which is full and excellent.

There are a few criticisms. It seems to this reviewer the book is weakest in the mathematics of pharmacy which is scattered through the book and that it would have been better to have had a small section on this subject. There is no section on prescription writing or incompatibility. The section on bacteriological technic gives more of general information on the subject than the actual technic. There are excellent historical introductions to each major subject, but a small section on history or at least a chronology of leading events would have been of value to the student and emphasized a subject too often neglected in the sciences. These features, however, are of a minor character compared to the general excellence of the book. It should be mentioned that the format and binding are fine and the latter is covered by a most attractive jacket.

PLASTER OF PARIS TECHNIQUE in the treatment of fractures and other injuries by *T. B. Quigley, Lieutenant Colonel, Medical Corps, Army of the United States; Instructor in Surgery, Harvard Medical School (in absentia); Junior Associate in Surgery, Peter Bent Brigham Hospital, Boston (in absentia)*. 104 pages; illustrated. The McMillan Company, New York, publishers, 1945. Price $3.50.

Plaster of paris body jackets, casts and splints are extensively used in military and civilian practice for the immobilization, protection and support of skeletal injuries. Everyone who uses plaster of paris well, must devote effort and study to perfect his technic. This effort is amply repaid for a well applied cast is comfortable to the patient and is an aid to his recovery. A poorly applied cast is an instrument of torture to the patient and a cause of mortification to the

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surgeon. The beginner in the use of plaster of paris will find this modest, profusely illustrated volume a gold mine of practical information. Much attention is devoted to positioning the patient so that the minimum assistance will be needed. The exact technic of the application of plaster of paris for a variety of conditions is described and illustrated. This book can be highly recommended, particularly to internes and residents.

KEY TO WEAVING. A Textbook of Hand-Weaving Techniques and Pattern Drafts for the Beginning Weaver by *Mary E. Black, O. T. B., Director, Handcrafts and Home Industries Province of Nova Scotia, Canada.* The Bruce Publishing Company, Milwaukee, Wisconsin. Price $5.00.

Weaving is a very difficult craft subject to cover without becoming too specific so that the reader easily becomes confused by detail.

This book is one of few that is drawn up in lesson form in logical sequence beginning with the simple and advancing to the more difficult techniques.

In this respect, KEY TO WEAVING can be equally useful to the student as well as a master of the art.

This book is recommended as one to be on the personal bookshelf of occupational therapists, to be used as a reference and a guidance in the intricacies of the art of weaving.

HERMANN RORSCHACH PSYCHODIAGNOSTICS. A Diagnostic Test Based on Perception, Including Rorschach's Paper, The Application of the Form Interpretation Test (Published Posthumously by *Dr. Emil Oberholzer*) Translation and English edition by *Paul Lemkau, M. D. The Henry Phipps Psychiatric Clinic, Baltimore, and Bernard Kronenberg, M. D., New York. Editor, W. Morgenthaler, M. D., Muri-Berne, Switzerland.* Distributors for the U. S. A., Grune and Stratton Inc., 443 Fourth Avenue, New York, N. Y. Price $5.75.

This book is the reply to the often expressed desire for an English translation of Hermann Rorschach's now classic "Psychodiagnostik." To Rorschach, a young Swiss psychiatrist who died prematurely in 1922, must go the credit for formulating a psychological testing instrument based on the conception that man symbolically structures the world around him in close conformity with his personality.

He devised ten amorphous inkblots, some of which are colored and some shaded in black and white. The subject whose personality is to be appraised is shown each of these blots in succession and is asked to say and describe what he sees and of what he is reminded. The responses which he makes, in the words of Rorschach, "fall in the field of perception and apperception rather than imagination." In simpler terms, the visual impressions of the inkblots stimulate a complex of memories of former sensations and former experiences. They are integrated and associated in accordance with the specific basic character of the subject. The emphasis which he places on whole parts and details, his manner of approach, the richness and flexibility of his

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response and the method he uses to organize his replies are indicative of his fundamental endowments, the quality of his personal and social adjustment, and his similarity to and difference from other persons. All of the responses are tabulated according to a rather elaborate technic, scored and interpreted. Experience over the years with thousands of tests given to all kinds and types of subjects has established frames of reference, against which the test under consideration is judged.

Like all examinations and tests of human personalities, its capacities, attitudes and behavior, the Rorschach test is as useful diagnostically as the examiner is competent. It is not a parlor trick, nor is it a royal road to the understanding of personality dynamics. But in the hands of a trained, careful investigator it is a valuable guide to a more complete understanding of the subject.

In the years since his death there has been much work done on refining Rorschach's basic contribution. It has served merely to confirm what Professor Eugen Bleuler of Burghlozli fame had to say: "Hermann Rorschach was the hope of an entire generation of Swiss psychiatry." This translation is a fitting tribute to a brilliant pioneer.

HUMAN BIOCHEMISTRY by *Israel S. Kleiner, Ph.D., Professor of Biochemistry and Physiology, New York Medical College, Flower and Fifth Avenue Hospitals: Formerly Associate, The Rockefeller Institute for Medical Research, New York.* 573 pages; with 70 text illustrations and five color plates. The C. V. Mosby Co., St. Louis, Mo., publishers. Price $6.00.

Up to the early twenties, students of medicine were confronted with the task of becoming specialist-anatomists. The study of anatomy was made the stumbling block which all successful medical students had to hurdle. As the years passed and the many biochemic problems presented themselves the inquisitive mind of man turned to this form of research. It was readily observed that the human body is nothing more or less than applied biochemistry, that human physiology is a series of biochemic reactions, and pathologic conditions, the result of disturbances of these reactions. Little time was lost in discovering that diagnosis and therapeutics were integral parts of biochemistry. Emphasis in medical schools then was directed towards this field of study. In short order, the study of biochemistry became to the modern student what anatomy was to the student of medicine several decades ago. As a result, voluminous chemical texts appeared in the literature, and the knowledge of their contents was asiduously demanded of the student. In no time the students became perplexed and discouraged.

Kleiner's Human Biochemistry however, has succeeded in presenting the fundamentals of biochemistry in a most appealing manner. The topics are discussed in such conversational tone that out of it even the dullard can make sense. The text is elementary, but in its elemen-

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tary form it is informative and comprehensive enough for the student to obtain a knowledge of biochemistry enabling him to discuss intelligently biochemical problems.

The volume is fluidly written and contains the most recent discoveries. In its simplicity, however, completeness has been sacrified and hence the text will probably never be used as a standard for medical colleges. It is a teachable work and permits the lecturer to fill in the many short points which punctuate this small volume.

Strictly a beginner's text, it may be highly recommended from this viewpoint. The difficult chemical reactions to the problems are wisely avoided and emphasis is placed more on the story of biochemical reactions and their relation to the human body than upon the presentation of many intricate formulas. For the beginner in biochemistry Kleiner's work has a most useful appeal.

HEY GROVES' SYNOPSIS OF SURGERY Illustrated. Edited by *Cecil P. G. Wakeley, C. B., D. Sc., F. R. C. S., F. R. S. E., F. A. C. S., F. R. A. C. S. Twelfth edition.* 632 pages. The Williams and Wilkins Co., Baltimore, Md., publishers, 1945. Price $6.00.

This handbook of surgery, obviously intended as a ready reference aid to students, interns, and general practitioners, serves this purpose admirably. The field of surgery, including anesthesia, orthopedics, urology, and neurosurgery is sketchily but comprehensively encompassed, and the concise, semi-abbreviated arrangement of the material presents a well summarized picture to the hurried reader. Of particular value in this respect are the chapters dealing with fractures, dislocations, and oncology. The few illustrations are well-placed and helpful.

To one interested in the details of surgery, this work will be disappointing in many regards. Controversial points are studiously avoided, many modern surgical views are lacking, and in most instances surgical technic is referred to in a few words. These shortcomings are, of course, a necessary evil in this type of predigested treatise.

An earnest effort has been made in the revision of the twelfth edition. The inclusion of sulfa and penicillin therapy, of some of the modern views regarding wounds, and of recent methods of amputation are noteworthy. In the final chapter are a number of well-labeled anatomic charts devoted to surface anatomy which constitute a valuable supplement. The index is accurate and complete, the binding excellent, and the small size of the volume is in keeping with its purpose.

DISEASES OF THE NERVOUS SYSTEM, Described for practitioners and students by *F. M. R. Walshe, O. B. E., M. D., D. Sc., F. R. C. P. (Lond.) Hon. D. Sc., National University of Ireland.* 360 pages; illustrated. 4th ed. The Williams and Wilkins Co., Baltimore, Md., publishers. 1945. Price $4.50.

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This is undoubtedly the briefest presentation of a subject which perhaps more than any other is shunned by both students and practitioners because of the aspect of great complexity, and difficulty of comprehension given to it by ill planned accounts. The author, with some twenty years of very active teaching experience in the field of Neurology, has been strongly impressed by the need for a simple text book of Neurology written for the ordinary practitioner and student instead of the professed specialist, and set out to provide one.

In this edition the author has made revisions of chapters on peripheral nerve lesions, herpes zoster, cervical rib, sciatica, and protrusion of the intervertebral disc, and has included new matter on the nature of etiology and the concept of psychosomatic illness, and on electroencephalography. The book otherwise retains the basic features of its predecessors as intended by the author. The principal ones are: Careful selection, emphasis, and omission of subject matter in keeping with the desired scope; avoidance of confusing terminology, especially eponyms whose use has somehow managed to survive mostly in neurology; only the few elementary facts of anatomy and physiology necessary to recognize and localize diseases of the nervous system; emphasis upon the story of evolution of disease of the nervous system rather than upon static symptom complexes that afford only a picture of the anatomical involvement and no information regarding pathogenesis; and a brief but very useful diagnostic account of the psychoneuroses. These of course are characteristics which the author has designedly imparted to the book in accordance with its purpose.

The book, however, has one other and very outstanding characteristic, through no deliberate intention upon the author's part. It will be best appreciated by those acquainted with some of the more important traits of its famous and colorful author through either personal contact or legend. These are clearly discernible throughout the book and make it truly unique. The following may be cited as examples: The very formal and meticulously precise style of writing, which though very attractive will no doubt prove strange and not too easy to read for some American readers; a dogmatic tendency; a very stimulating critical attitude, and frequent personal views based upon a vast clinical experience and theoretical knowledge.

The following excerpts are illustrative: Regarding the psychological causation of enuresis in children, the author concludes, "In the circumstances the psychological fantasies that do duty for explanation should be regarded with complete scepticism." About the Sciatic Syndrome he states: "More recently, rupture of an intervertebral disc, between fourth and fifth lumbar or between fifth lumbar and first sacral vertebrae, with herniation into the spinal canal of the nucleus pulposus of the disc has been increasingly invoked not only

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as a cause, but as *the* cause of all cases of sciatica. Yet others regard lumbar spondylitis or lesions of the sacroiliac joint as the essential factors. Common to all these hypotheses is the craving of the authors to simplify the problem by invoking a single pathology for all cases, but nature is not interested in simplicity, certainly not in purely verbal simplifications, and the probability is that while acute single-attack cases may be due to an interstitial neuritis, a proportion, as yet unknown, of chronic and recurrent cases may follow upon herniation of an intervertebral disc and the compression of fifth lumbar, first or second sacral roots."

This feature of the book, that is, its presentation of the author himself, makes it valuable to those professed neurologists who have not had the benefit of personal association with the author but who may through his book, should they desire, feel in some measure the particular influence the author has exerted as a renowned teacher. Aside from this, four editions in less than five years readily attest to the popularity of the book, and, it should follow, to how far the author has succeeded in achieving his aim of making generally available a brief, simple, instructive, and useful book of clinical neurology for a circle of readers who have most felt the need.

AN INDEX OF DIFFERENTIAL DIAGNOSIS OF MAIN SYMPTOMS, by various writers; edited by *Herbert French, C. V. O., C. B. E., M. A., M. D. Oxon., F. R. C. P., Consulting Physician, Guy's Hospital; assisted by Arthur H. Douthwaite, M. D., F. R. C. P., Physician, Guy's Hospital.* 6th edition. 1128 pages; 798 illustrations, of which 231 are colored. The Williams & Wilkins Co., Baltimore, Md., publishers, 1945. Price $17.

This volume needs no introduction to the medical profession of this country. It has gone through numerous editions, and this present edition, the sixth, shows a wide revision with the addition of the newer laboratory tests and diagnostic procedures.

The arrangement of the subject matter has been satisfactory to medical students and practicing physicians alike since the first edition of this book was presented. The unique mode of presentation possesses a distinct value in the rapid survey of a disease problem through its presenting symptoms, although completeness in the presentation and discussion of symptoms has never been sacrificed for brevity.

The present edition has lost none of the valuable characteristics of the numerous previous editions. It is well, extensively and happily illustrated, a fact which aids in approach to an understanding of the particular diseases under consideration. The illustrations serve as diagnostic adjuvants.

The editors and publishers of this new edition deserve much credit for their efforts in bringing up to date this thoroughly worthwhile volume in spite of many technical and professional obstacles. It can be recommended most wholeheartedly to those who have never made

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its acquaintance, especially those of the younger practitioners, and to those who wish to renew a friendship of many years standing.

A TEXTBOOK OF SURGERY, by *John Homans, M. D., Clinical Professor of Surgery, Emeritus.* Compiled from lectures and other writings of members of the Surgical Department of the Harvard Medical School. With a Special Bibliographical Index and with illustrations by *Willard C. Shepard and others.* 6th edition, 1278 pages. Charles C Thomas, Springfield, Ill., publisher, 1945. Price $8.

This is the 6th edition of a general treatise on the principles and practice of surgery originally published in 1931 from a compilation of lectures and other writings of members of the Surgical Department of the Harvard Medical School. By removing old material to make room for the inclusion of newer information, the same pagination as obtained formerly has been maintained.

This book is remarkably comprehensive in scope but by adhering to consciseness the author has, while avoiding prolixity, covered each subject in a thoroughly informative manner without the sacrifice of clarity. The technic of approach to each subject is interesting and the descriptive style engaging. The necessity for the observance of conservatism is a dominant quality of this book. Although a conscientious effort has been made at least to mention the newer therapeutic agents which have been introduced, such as the sulfa drugs, penicillin and thiouracil, and the newer operative procedures and measures which under the stimulus of the late war or otherwise, have been evolved, nevertheless the wisdom of accepting new agents, ideas and methods with reservation until sufficient time has elapsed to permit an adequate appraisal and an intelligent evaluation is shown. Operative details are, in the main, omitted. The arrangement of the subject matter in this book is essentially orthodox; however, in it are embodied several unique features, notable among which are, at the beginning of each chapter, a brief historical buildup or introduction, and, where appropriate, a review of the anatomy and physiology of the system or organs to be dealt with in a particular chapter. These features are not only of sound informative value but the reader is led into the subject pleasantly and with a refreshed sense of acquaintance. Another rather unusual feature is a bibliographical index of 73 pages in a single section which lends to the book an encyclopedic quality. From a literary standpoint the book is colorful, individualistic, and singularly direct in its intent.

It is difficult to select chapters of outstanding attractiveness and worth, as the very nature of the method by which the book was compiled makes each chapter an authoritative dissertation and a complete story within itself. For freedom from excessive detail, simplicity of description, and ease of understanding, the chapter on the sympathetic and parasympathetic nervous systems is a masterpiece. Separate chapters on the eye, the ear, the nose, accessory sinuses, and pharynx

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as well as a chapter of 36 pages on gynecology and one of 51 pages on genitourinary diseases epitomize their respective subjects in so masterful a manner as to constitute as complete a text on these specialties as one would expect to find in a volume devoted exclusively to such subjects. This is undoubtedly the type of book to which modern medical students could become attached in much the same respect as students of yesteryear became (and have remained) attached to Gray's Anatomy and DaCosta's Surgery.

The illustrations, 530 in number, all in black and white, are of a simple quality. Indeed the first impression is that they are severely so; however they depict clearly enough what they are intended to depict.

The text paper is 135-pound white Lexington English finish. The type face is 8- and 10-point leaded, and the reading of this print may be found a little tedious. However, since it is primarily designed as a student's textbook, the cause of the presbyopic, in whom vanity is still reluctant to give way before the inevitable conquest of advancing years, is naturally not a primary consideration.

GENERAL AND PLASTIC SURGERY WITH EMPHASIS ON WAR INJURIES, by *J. Eastman Sheehan, M. D.* 341 pages, illustrated. Paul B. Hoeber, Inc., Medical Book Department of Harper & Brothers, New York, publishers, 1945. Price $6.75.

The reviewer is at a loss to determine the exact purpose of this short book on general and plastic surgery, which has been produced by the well-known plastic surgeon. It has an abundance of illustrations taken largely from other authors. In an attempt to cover such a wide scope, it has been impossible to do justice to the material except in a superficial way. The general principles covered are relatively accurate, but little new has been added.

In evaluating some of the technics outlined, criticism should be made of certain plastic procedures, because they are not up to date in all cases. Too much emphasis is placed on the use of pinch grafts in the covering of granulating burn defects. The majority of plastic surgeons prefer large grafts of skin because of the better functional and cosmetic results obtained. The use of a pedicle flap from the back, figs. 118 to 121, to repair defects of the palm, is obsolescent because of the extreme thickness of the skin. Likewise, utilization of scalp flaps to repair chin defects is not acceptable in America because full beards are not in style, and the daily shaving of this tough hair is well nigh impossible. The use of plasma and white cell fixation of skin grafts has been abolished by plastic surgeons as an unnecessary step, as each patient produces his own natural physiologic coagulum.

The use of any free graft on the face, as shown in fig. 403, should be avoided except as a last resort, since its final cosmetic appearance is apt to be that of a patch. Removal of such lesions by multple ex-

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cision and primary suture is preferable. In describing bone grafts to the mandible, no mention is made of utilizing iliac bone chips, whose use is very simple and certain.

For the benefit of American readers who are unfamiliar with British terminology, it should be pointed out that "medical spirit" should be translated as alcohol, and "wool" as ordinary absorbent cotton.

CLASSIC DESCRIPTIONS OF DISEASE With Biographical Sketches of the Authors, by *Ralph H. Major, M. D., Professor of Medicine, University of Kansas School of Medicine.* 3d edition. 678 pages, illustrated. Charles C Thomas, Springfield, Illinois, publisher, 1945. Price $6.50.

This is a book not only interesting, entertaining and informative to read but also one which may be regarded as source material. One comes face to face with most of the celebrities in medicine from earliest times to the recent investigators of our own day. A brief biography of each famed individual is given, followed usually by either his own or an accepted description of that particular disease, condition, investigation, remedy or other factor for which he is considered the discoverer, developer or for which he is famous. Certain comparisons with the findings or opinions of others are introduced to enhance the original effect.

Long forgotten or commonly unknown details or facts are brought to one's attention, so that a new life and an over weening interest is aroused to mollify our modern ways of thought and investigation and to make one realize what a rough road, and what dark unknown depths were penetrated, sometimes by chance and yet again purposefully, by these forebears in the profession to place before our present-day eyes what we accept as foregone and positive yet in those bygone days was vague, improbable, and secrets of nature.

This is the third edition (the first appearing in August 1932). The contents are arranged first by the class of disease and then a grouping of those diseases according to origin or region or kind. (Infectious diseases; deficiency diseases, etc.) The several authorities are then grouped accordingly under the particular item of which he is the discoverer or investigator so that there is ease in finding whomsoever one seeks. Where the authority is concerned with more than one item credit is duly given elsewhere. Where the remedy for a disease or condition is the principle reason for fame the author's original essay is quoted under the disease for which it is used.

One may browse around in the book by the hour with always an engaging account to peruse. It is not tiring. The style of the author is excellent and the contrasts between the text and interpolated statements or descriptions by the famous authority are amusing from the standpoint of the language used as well as from the error in findings of fact which we now know are otherwise than as stated.

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However, one is able to read the original description of disease as written by him who has become recognized as the discoverer or propounder and to see with what keen observation and discernment he brought to light and to our knowledge what has now become established, with all complications, peculiarities, variants and the like, and found in the latest version in our modern textbooks. This is a pleasure in itself and gives to the book a qualty not found elsewhere in everyday reading.

The author has done a masterful piece of work. His compilation of material and its arrangement could hardly be improved upon; and what delving and searching the author went through can only be imagined. Classic Description of Disease should be in the library of every doctor of medicine or scientist for casual reading, for reference, and for its intrinsic value.

RORSCHACH'S TEST II. A variety of Personality Pictures by *Samuel J. Beck, Ph. D., Head of Psychology Laboratory, Department of Neuropsychiatry, Michael Reese Hospital, Chicago; Associate Professor of Psychology, Northwestern University. Foreword by Roy R. Grinker, Lt. Col., M. C.* 400 pages. Grune & Stratton, New York, publishers, 1945. Price $5.00.

This is the third volume on Hermann Rorschach's ink blot personality test by a clinical psychologist who has been occupied with the establishment of the test's clinical validity. Dr. Beck's earlier works "Introduction to the Rorschach Method" and "Rorschach's Test—Basic Processes" are the forerunners of this book which deals with clinical application and interpretation.

In Part I, the author summarizes the psychological significance of the various test factors. His is a concise resumé, adequately substantiated by his own and other workers' data. Dr. Beck has leaned somewhat upon psychonalytical language and concepts but has cautiously refrained from laboring the test with the responsibility for gratuitous analytic values. His interpretive analysis seems wholly reasonable and based upon objective evidence which the test technique itself can support.

Part II is the most valuable part of his presentation. It is a delineation of the personalities of 43 individuals. The author with skill and care has deftly shown the flexibility of Rorschach's instrument. The case material is widely varied—men, women, and children, a superior university president, a profoundly neurotic negro, a very feeble-minded boy illustrate its breadth and range. In each case a detailed protocol is presented with the tabulated response summary; a careful interpretation with the background judgment comes next and finally there is a brief clinical note which is a synopsis of relevant biographical material.

This book is recommended as an excellent handbook of Rorschach

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analysis. It has the double advantage of being scientifically credible and well written.

ESSENTIALS OF NEURO-PSYCHIATRY. A Textbook of Nervous and Mental Disorders by *David M. Olkon, S. B., A. M., M. D. Associate Professor of Psychiatry. College of Medicine, University of Illinois.* 310 pages; illustrated with 135 engravings. Lea & Febiger, Philadelphia, Pa., publishers, 1945. Price $4.50.

This book, dedicated to a rational understanding of psychiatry, is a calumnious travesty on a scientific medical text. The author's statement that "as a matter of experience one gropes as if in the dark" is not as much an explanation of his mauling of fact as it is a compounding of the disservice he does psychiatry. When under "Psychotherapy," he says: "If, for example, he (the patient) has used cold water for relief and without benefit, suggest a compress made of some hot substance with a tablespoonful of sugar in it to make the impression more grotesque. It will bewilder him, why the use of sugar, but it will have suggestive effects and it will do no particular harm to him. It requires considerable ingenuity to keep suggestibility impressive and workable," one is convinced that this is pure and simple chicanery.

The author pays profuse lip service to many of modern psychiatry's tenets: The patient-as-person concept, the social determinant of illness and health, the need for a scientific methodology and a precise manner of communicating scientific facts. Unfortunately his efforts cease at this point. He is given to condemnations and equally sonorous pronouncements. At one juncture he says, "One must cast aside verbalisms," "scholastic terminology," and "mysterious phraseology," and then comes out with "colloidoclasic," "allocheiria," "daemmerzustand" and "pavor nocturnus." He uses the terms "neurosympathetic," "vasoneurosis." He captions figure 35, "delusional insanity." He makes a distinction (without a difference) between "neuroses" and "psychoneuroses." He speaks of hysteria as coming on in "attacks." On page 146 he quotes a 5-line reference in its original German text and then proceeds to translate it into English. He devotes 6 pages to a lengthy presentation of one case of Transvestitism (reprinted from an earlier journal publication) and gives 6½ pages to the chapter "Therapy of the Psychoneuroses." All in all he presents a hotchpotch of garbled information and alleged scientific documentation of untenable constructions.

Throughout the book's 32 chapters (many of which are only 1½ pages) the author consistently displays a complete lack of appreciation of psychopathology. This book is not recommended to those who are interested in the essentials of psychiatric technic or psychiatric doctrine.

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SURGICAL NURSING, *by Eldridge L. Eliason, A. B., M. D., Sc. D., F. A. C. S., John Rhea Barton Professor of Surgery, University of Pennsylvania Medical School; L. Kraeer Ferguson, A. B., M. D., F. A. C. S., Captain (MC) USNR, Assistant Professor of Surgery, University of Pennsylvania Medical School; and Evelyn M. Farrand, R. N., B. S., Formerly Instructor in Nursing Arts and Surgical Nursing, University of Pennsylvania School of Nursing.* 7th edition. 585 pages; 259 illustrations with 7 subjects in full color. J. B. Lippincott Co., Philadelphia, Pa., publishers. Price $3.25.

Frequently a book is encountered which has a specific need and use. Such is this compact volume which contains so much practical information about surgical nursing. At first glance the volume seems valuable only to the nursing staff but upon closer examination, the text, illustrations, and discussion of anatomy, physiology and surgical therapy as well as nursing care, make it valuable to the surgical staff of every hospital. In fact every physician who has a surgical service will realize the importance of this book as a teaching aid.

The pre- and postoperative care of surgical patients has become increasingly important and is so involved with the nursing care that it is difficult to find a textbook or article which covers the subject.

The authors of this book, in revising it for the seventh edition, have made every effort to present systematically and discuss the problems encountered. Illustrations of the different bandages, instruments, utensils, autoclaves, sterilizers, needles, and sutures, as well as methods of examination, make the book valuable to interns and graduate students of medicine as a reference work. The Wangensteen apparatus and tidal drainage equipment are illustrated and explained, as well as orthopedic and neurosurgical appliances.

At the end of each chapter there are references and suggested readings, with an outline for conference material.

This new edition has been so carefully compiled that it should be available to every intern, resident, and graduate student of surgery, as well as the surgical nurse.

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PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge

MAMMALS AND PLAGUE DISTRIBUTION IN THE UNITED STATES

WILLARD H. LAHNUM

Lieutenant, junior grade H (S) U. S. N. R.

Native rodents, as hosts of bubonic plague, possess a place of prime importance in the spread of this disease in the United States. Under wartime conditions, resulting in transient populations and the development of military centers at remote locations in the United States, an increased percentage of the population was placed in a position for possible exposure to this disease. The distribution of human and rodent plague, as presented here, is a compilation from many sources intended to be of aid to personnel engaged in rodent control work.

The first human case of bubonic plague on record in the United States was found at San Francisco, Calif., in 1900. From that date to May 15, 1945, there have been 504 reported cases with 318 deaths or a mortality rate of 63 percent (table I). The first cases were supposedly a result of infection from rats of foreign origin, although the first rat infection was not demonstrated until 1902.

Due to the presence of large numbers of ground squirrels, Citellus beecheyi, in the San Francisco area, it is easy to visualize the possible spread of bubonic plague infection from the exotic rats to the native rodents. The first report of plague infection in Citellus beecheyi was made in 1908 in California. Investigations by the U. S. Public Health Service and the various State health departments have been conducted, with various degrees of intensity, throughout the intervening years, in the search for plague-infected rodents or their ectoparasites. The presence of plague has been demonstrated in all the Pacific Coast States, and infected native rodents have been found progressively eastward throughout the yearly investigations, until the present boundary includes North Dakota, Oklahoma and the Gulf States of Texas, Louisiana, and Florida.

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TABLE 1.—*Plague in the United States, 1900–1944*

Year	No. cases	No. deaths	Percent mortality	Year	No. cases	No. deaths	Percent mortality
1900	22	22	100.0	1924	41	34	82.9
1901	30	26	86.6	1925			
1902	41	41	100.0	1926			
1903	17	17	100.0	1927	1	1	100.0
1904	10	8	80.0	1928	3	2	66.6
1905				1929			
1906				1930			
1907	181	90	49.1	1931			
1908	9	5	55.5	1932			
1909	3	1	33.3	1933	1	1	100.0
1910	3	1	33.3	1934	2	1	50.0
1911	4	1	25.0	1935			
1912				1936	4	0	0.0
1913	2	2	100.0	1937	2	1	50.0
1914	31	10	32.2	1938			
1915	2	1	50.0	1939	1	0	0.0
1916				1940			
1917				1941	2	2	100.0
1918				1942	1	1	100.0
1919	28	18	74.2	1943	2	1	50.0
1920	51	27	52.2	1944	1	0	0.0
1921	6	4	66.6				
1922	2	0	0.0	Totals	504	318	63.0
1923	1	0	0.0				

Although plague investigations for years were more or less confined to exotic rats and California ground squirrels, surveys since 1934 have been broadened to include all available rodents and occasionally other mammals. The number of species of mammals or their ectoparasites that have been found to be infected with plague has rapidly increased since that date (table 2). The number of species that might have been found infected prior to that date if exhaustive collections and examinations had been made is subject to question. The first plague found east of the Sierra Nevada Mountains was in 1934.

TABLE 2.—*Mammalian reservoir of plague in the United States*

(A list of mammals that have been found to be infected or to possess ectoparasites infected with plague)

Common name	Scientific name	State where collected	County	Year
Order	RODENTIA			
Family	SCIURIDAE			
GROUND SQUIRRELS				
Uinta	Citellus armatus	Idaho	Bonneville	1936
		Utah	Wasatch	1937
		Montana	Gallatin	1938
		Wyoming	Uinta	1938
California	C. beecheyi beecheyi	California	Contra Costa	1908
		Nevada	Ormsby	1937
Douglas	C. beecheyi douglasi	California	Siskiyou	1941
		Oregon	Jackson	1942
Fisher's	C. beecheyi fisheri	California	San Bernardino	1936
Belding's	C. beldingi beldingi	California	Eldorado	1941
Oregon	C. beldingi oregonus	California	Modoc	*1934
		Oregon	Lake	1935
		Nevada	Elko	1940

*First instance of plague found east of Sierra Nevada Mountains.

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TABLE 2.—*Mammalian reservoir of plague in the United States*—Continued

Common name	Scientific name	State where collected	County	Year
GROUND SQUIRRELS-Con.				
Columbian	C. columbianus columbianus	Oregon	Wallowa	1935
		Montana	Beaverhead	1935
		Washington	Spokane	1939
Blue Mountain	C. columbianus ruficaudus	Oregon	Wallowa	1939
Wyoming	C. elegans	Nevada	Elko	1936
		Montana	Beaverhead	1937
		Wyoming	Uinta	1938
Richardson	C. richardsoni	Montana	Beaverhead	1938
		North Dakota	Divide	1941
Nevada	C. richardsoni nevadensus	Nevada	Elko	1936
Say's	C. variegatus grammurus	Utah	Morgan	1937
		New Mexico	Catron	1938
		Colorado	San Miguel	1941
Utah	C. variegatus utah	Utah	Beaver	1936
Loring's	C. washingtoni loringi	Washington	Stevens	1938
Washington	C. washingtoni washingtoni	Washington	Adams	1937
Townsend's	C. townsendi mollis	California	Lassen	1942
		Nevada	Washoe	1942
Piute	C. townsendi mollis	Idaho	Ada	1941
		Nevada	Washoe	1942
		Oregon	Malheur	1942
Antelope	C. leucurus	California	San Bernardino	1942
Golden Mantled	C. lateralis chrysodeirus	California	San Bernardino	1937
Sand Hill Stripped	C. tridecemlineatus	New Mexico	Torrence	1943
CHIPMUNKS				
Tahoe	Eutamias speciosus frater	California	Eldorado	1936
		Nevada	Ormsby	1937
TREE SQUIRRELS				
Tamarack	Sciurus douglasi albolimatus	California	Fresno	1937
Sierra Flying Squirrel	Glaucomys sabrinus lascivus	California	Fresno	1937
MARMOTS				
Engelhardt	Marmota flaviventris engelhardti.	Utah	Beaver	1936
Golden Mantled	M. flaviventris nosophora	Montana	Beaverhead	1936
	M. flaviventris	Idaho	Bannock	1938
		Oregon	Lake	1940
		California	Lassen	1942
	M. flaviventris avara	Oregon	Malheur	1941
Warren's	M. flaviventris warreni	Colorado	San Miguel	1941
		Wyoming	Lincoln	1938
PRAIRIE DOGS				
Utah	Cynomys parvidens	Utah	Garfield	1936
White tailed	C. leucurus	Wyoming	Uinta	1938
Zuni	C. gunnisoni zuniensis	New Mexico	Catron	1938
		Arizona	Apache	1938
Arizona	C. ludovicianus arizonensis	New Mexico	Lincoln	1943
Gunnison	C. gunnisoni gunnisoni	Colorado	Huerfano	1943
	C. ludovicianus	Colorado	Las Animas	1943
		Wyoming	Johnson	1943
		Montana	Garfield	1943
Family	GEOMYIDAE			
POCKET GOPHER	Thomomys sp	California	San Luis Obispo	1942
Family	HETEROMYIDAE			
KANGAROO RAT	Dipodomys ordii ordii	New Mexico	Dona Ana	1939
Family	MURIDAE			
NATIVE RATS AND MICE				
Cotton Rat	Sigmodon hispidus	New Mexico	Quay	1944
Harvest Mouse	Reithrodontomys megalotis	California	Monterey	1942
Grasshopper Mouse	Onychomys leucogaster arctipes.	New Mexico	Quay	1943
	O. torridus torridus	New Mexico	Lincoln	1943
Whitefooted Mouse	Peromyscus truei gilberti	California	Modoc	1934
	P. truei truei	California	Monterey	1934
	Peromyscus sp	New Mexico	Catron	1938
	Peromyscus sp	Oklahoma	Cimarron	1944
	Peromyscus sp	Washington	Pierce	1944
Meadow Mouse	Microtus californicus	California	San Luis Obispo	1942
	M. townsendi	Washington	Pierce	1944

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TABLE 2.—*Mammalian reservoir of plague in the United States*—Continued

Common name	Scientific name	State where collected	County	Year
WOODRATS	Neotoma fuscipes	California	Alameda	1909
Mohave Desert	N. fuscipes mohavensis	California	San Bernardino	1934
		Nevada	Clark	1938
Ruddy	N. floridana rubida	Louisiana	Orleans	1920
Bailey's	N. floridana baileyi	Oklahoma	Cimarron	1944
Western Bushytailed	N. cinera occidentalis	California	Modoc	1934
Gray Bushytailed	N. cinera	Utah	Kane	1938
Desert	N. desertorum	Utah	Kane	1938
		Nevada	Clark	1939
Thomas'	N. lepida	Nevada	Clark	1938
Rhoade's	N. intermedia intermedia	California	Santa Clara	1927
Woodrat	N. albigula	New Mexico	Quay	1943
EXOTIC RATS AND MICE				
Brown Rat	Rattus norvegicus	California	San Francisco	1902
		Washington	King	1907
		Louisiana	Orleans	1912
		Florida	Escambia	1920
		Texas	Jefferson	1920
Roof Rat	Rattus rattus alexandrinus	Louisiana	Orleans	1914
		California	Placer	1937
		Washington	Pierce	1942
Black Rat	Rattus rattus rattus	Louisiana	Orleans	1914
		Texas	Galveston	1920
		Washington	Pierce	1942
House Mouse	Mus musculus	Louisiana	Orleans	1914
		California	Marin	1942
Family	LEPIDORIDAE			
HARES AND RABBITS				
California Jackrabbit	Lepus californicus	California	San Luis Obispo	1942
Washington Cottontail	Sylvilagus nuttallii	Washington	Lincoln	1939
San Diego Cottontail	S. auduboni sanctidiegi	California	Ventura	1942
California Brush Rabbit	S. bachmani	California	Monterey	1942
Order	CARNIVORA			
Badger	Taxidea taxus neglecta	Oregon	Malheur	1942
PLAGUE PROBABLES ARISING FROM CASES OF HUMAN PLAGUE				
Coyote	Canis latrans	Utah		1939
Mink	Mustela vison	Alberta, Canada		1939




SENSITIZATION OF PNEUMOCOCCUS TYPE 1 TO PENICILLIN

A striking synergism was obtained between antipneumococcus serum and penicillin with type 1 pneumococcus (I) even when I was rendered relatively penicillin resistant. I, sensitized by contact with dilute specific antiserum in vitro, possessed a higher sensitivity toward penicillin in vivo than the unsensitized organisms.—KELLY D. R., and SCHNITZER, R. J.: Sensitization of pneumococcus type 1 towards penicillin by specific antipneumococcus serum. Chem. Abstracts **39**: 5277, November 20, 1945.

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NOTES ON OUR RESERVE CONTRIBUTORS

Bourke, Anne R., Lieutenant, junior grade H(W) USNR (*Fulminating Septicemia Due to Staphylococcus Epidermidis*, p. 751). B. S., University of Maryland, 1937. Bacteriologist, Florida State Board of Health, 1937–1938, and Army Medical School, Army Medical Center, Washington, D. C., 1938–1944. Member American Society of Bacteriologists.

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Breese, Burtis B., Commander (MC) USNR (*Failure of Type Specific Streptococcus Pyogenes Vaccine to Prevent Respiratory Infections*, p. 709). M. D., Harvard Medical School, 1931. Intern, Johns Hopkins Hospital, Baltimore, Md., 1931–32, and New York Hospital, New York City, 1932–33; assistant resident pediatrician, 1933–34, and resident pediatrician, 1934–35, Strong Memorial Hospital, Rochester, N. Y.; associate pediatrician, Rochester General Hospital, Rochester, N. Y.; staff, Strong Memorial Hospital; instructor, pediatrics, University of Rochester School of Medicine and Dentistry. Fellow: American Medical Association and American Academy of Pediatrics. Diplomate: American Board of Pediatrics and National Board of Medical Examiners.

Chambers, Jack V., Commander (MC) USNR (*Cutaneous Diphtheria*, p. 744). A. B., 1930, and M. A., 1931, Stanford University; M. D., Stanford University School of Medicine, 1936. Intern, assistant surgical resident and surgical resident, Sacramento County Hospital, Sacramento, Calif., 1935–38; private practice, Sacramento, Calif., 1938–41. Member: California Medical Association and Sacramento Society for Medical Improvement.

Corey, Edward Lyman, Commander H(S) USNR (*Medical Aspects of Blast*, p. 623). A. B., Western Reserve University, 1924; Ph. D., Yale University, 1928. Assistant in biology, Western Reserve University, 1921–24; Sterling fellow, Yale University, 1927–28; instructor, New York University, 1928–29; assistant professor, physiology, University of Virginia Department of Medicine, 1929–42, and 1945–. Fellow: American Association for the Advancement of Science; member: American Physiological Society, American Association of Anatomists, American Society of Zoologists, Society for Experimental Biology and Medicine.

Crile, George, Jr., Commander (MC) USNR (*Traumatic Rupture of Adductor Muscles of the Thigh*, p. 719). M. D., Harvard Medical School, 1933. Fellow in surgery, 1934–36, and resident, July 1937–Nov. 1937, Cleveland Clinic

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Foundation Hospital, Cleveland, O.; resident in gynecology, Roosevelt Hospital, New York City, Jan. 1937–June 1937; surgical staff, Cleveland Clinic, 1935–. Fellow: American College of Surgeons and American Medical Association; member: American Association for the Study of Goiter and Ohio State Medical Association. Diplomate: American Board of Surgery and National Board of Medical Examiners. Coauthor, Hospital Care of the Surgical Patient, Charles C Thomas, Springfield, Ill., 1942.

Edwards, J. Willard, Commander (MC) USNR (*Effect of Blood Donations on Blood Pressure of Hypertensives*, p. 736). B. S., University of Minnesota, 1926; M. D., University of Minnesota Medical School, 1928. Intern, 1928, and special surgical assistant, 1931–34, Chicago Memorial Hospital, Chicago, Ill.; staff, St. Luke's Hospital and St. Joseph's Hospital, St. Paul, Minn. Member: American Medical Association, Minnesota State Medical Association, Ramsey County Medical Society, and American-Soviet Medical Society.

Errington, Allison F., Commander (MC) USNR (*Failure of Type Specific Streptococcus Pyogenes Vaccine to Prevent Respiratory Infections*, p. 709). M. D., Ohio State University College of Medicine, 1926. Intern, City Hospital, 1926–27, and Goodyear Hospital and Dispensary, 1927–28, Akron, Ohio; private practice, Akron, 1927–42; staff, Children's Hospital, Akron. Member: Summit County Medical Society and Ohio State Medical Association.

Goodale, Raymond H., Captain (MC) USNR (*Pinta-like Lesions among Natives of Guam*, p. 653). B. S., Wesleyan University, 1920; M. D., Harvard Medical School, 1924. Adjunct professor in pathology, American University, Beirut, Syria, 1926–29; associate pathologist, 1929–31, and pathologist, 1931–, Worcester City Hospital, Worcester, Mass.; assistant professor in experimental pathology, Boston University School of Medicine, 1935–45. Member: American Medical Association, American Association of Pathologists and Bacteriologists, and New England Pathological Society. Diplomate American Board of Pathology. Author, Interpretation of Laboratory Findings, 1936.

Gottlieb, Mack L., Commander (MC) USNR (*Impressions of a POW Medical Officer in Japanese Concentration Camps*, p. 663). B. S., College of the City of New York, 1926; M. D., New York University Medical School and the Bellevue Hospital Medical College, 1930. Postgraduate work, internal medicine and cardiology, University of Vienna, and University College Hospital and Queens Square Hospital, London, 1932–1933; associate physician, French Hospital, New York City, 1938–. Fellow American Medical Association; associate American College of Physicians; member New York County Medical Society. Diplomate American Board of Internal Medicine.

Grussendorf, Leroy V., Ensign H(S) USNR (*Failure of Type Specific Streptococcus Pyogenes Vaccine to Prevent Respiratory Infections*, p. 709). B. A., Gustavus Adolphus College, 1938. Instructor in general science and mathematics, High School, Coleraine, Minn., 1938–42.

Hasenbush, Lester L., Lieutenant, junior grade (MC) USNR (*Method for Practicing Preventive Psychiatry in a Naval Personnel Separation Center*, p. 696). B. S., University of Chicago, 1934; M. D., Johns Hopkins University School of Medicine, 1938. Intern in Medicine, Beth Israel Hospital, Boston, Mass., Oct. 1938–Jan. 1940; assistant resident at the Neurological Institute, New York City, April 1940–Feb. 1942; resident psychiatrist and instructor in psychiatry, Johns Hopkins Hospital, Baltimore, Md., Feb. 1942–. Member: American Psychiatric Association, Association for Research in Nervous and Mental Diseases. Diplomate American Board of Psychiatry and Neurology.

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Hays, Frank M., Lieutenant (MC) USNR (*Meningococcal Conjunctivitis*, p. 758). M. D., University of Tennessee College of Medicine, 1943. Intern, Hillman Hospital, Birmingham, Ala., 1943–44. Member: American Medical Association and Mississippi State Medical Association.

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Kaske, Gordon J., Commander (MC) USNR (*1,265 Pneumonia Cases with No Deaths*, p. 731). B. S., University of Wisconsin, 1928; M. D., University of Wisconsin Medical School, 1930. Intern, Lutheran Deaconess Home and Hospital, Chicago, Ill., 1930–31; private practice, Belvidere, Ill., 1931–; postgraduate work, internal medicine, Massachusetts General Hospital, Boston, Mass., 1940. Fellow American Medical Association; member Illinois State Medical Society.

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Newman, Louis B., Commander (MC) USNR (*Method for Producing Soapy Solution in Whirlpool Tank*, p. 761). M. D., Rush Medical College, University of Chicago, 1931; M. E., Armour College of Engineering, Illinois Institute of Technology, Intern, Cook County Hospital, Chicago, Ill., 1932–33; attending staff, department of physical medicine, Cook County Hospital and Loretto Hospital, Chicago, 1933; private practice, 1933–. Fellow: American Medical Association and American Congress of Physical Medicine; member: American Society of Physical Medicine, American Society of Mechanical Engineers, Illinois State Medical Society, Chicago Medical Society, and Society of American Military Engineers.

Otness, H. Robert, Lieutenant H(S) USNR (*The Mental Defective and the Under-Age Man in the Navy*, p. 690). A. B. and M. S., University of Idaho, 1932; Ph. D., New York University, 1939. Psychologist, New York State Training School for Boys, Warwick, N. Y., 1938–39; chief clinician, Training School, Vineland, N. J., 1939–43. Member: American Psychological Association, American Association for the Advancement of Science, American Association on Mental Deficiency, New Jersey Association of Psychologists, and Association for the Advancement of Psychotherapy.

Parker, Leon O., Captain (MC) USNR (*Segregated Training for Recruits with Minor Orthopedic Disabilities and Complaints*, p. 676). B. S., Indiana University, 1924; M. D., Indiana University School of Medicine, 1926. Intern, U. S. Marine Hospital, Stapleton, N. Y., 1926–27, U. S. Marine Hospital, New Orleans, La., 1927–29, and U. S. Marine Hospital, San Francisco, Calif., 1929–30; private practice, San Francisco, 1930–; assistant in orthopedic surgery, Stanford University Hospitals, 1931–36; University of California Medical School, 1936–. Fellow: American College of Surgeons and American Medical Association; member: San Francisco County Medical Society, California Medical Association, and Western Orthopaedic Association. Diplomate American Board of Orthopaedic Surgery.

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Schafer, Walter L., Commander (MC) USNR (*Shigellosis Studies*, p. 704). A. B., Capital University, 1934; M. D., Ohio State University College of Medicine, 1937. Intern, Ohio Valley General Hospital, Wheeling, W. Va., 1937–38; resident in pediatrics, Children's Hospital, Columbus, Ohio, 1938–39; chief resident in pediatrics, T. C. Thompson Children's Hospital, Chattanooga, Tenn., 1939–40; fellowship in medicine, Wheeling Clinic, Wheeling, W. Va., 1940–41; pediatric resident, Dr. Henry John's Camp for Diabetic Children, Cleveland, Ohio, 1940. Associate American College of Physicians.

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Shaw, Christopher C., Captain (MC) USNR (*Fulminating Septicemia due to Staphylococcus Epidemidis*, p. 751). M. D., University of Maryland School of Medicine and College of Physicians and Surgeons, 1931. Instructor in pathology, University of Maryland, 1932–33; resident in tuberculosis, Baltimore City Hospitals, Baltimore, Md., 1933–34; resident in medicine, Metropolitan Life Insurance Co. Sanatorium, Mount McGregor, N. Y., 1934–35; commonwealth postgraduate medical fellow, Harvard University, 1940; educational director, American College of Physicians. Fellow: American College of Physicians and American Medical Association; member: Vermont State Cancer Commission and Vermont Tuberculosis Association. Diplomate National Board of Medical Examiners and American Board of Internal Medicine.

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White, Benjamin V., Jr., Lieutenant Commander (MC) USNR (*Shigellosis Studies*, p. 704). B. A., Princeton University, 1930; M. D., Harvard Medical School, 1934. Intern, Peter Bent Brigham Hospital, Boston, June 1934–Nov. 1935, and New Haven Hospital, New Haven, Conn., Jan.–Sept. 1936; Jeffrey Richardson Fellow, Harvard Medical School, 1936–38; assistant to pathologist, 1938–39, clinical assistant in medicine, 1938–41, and assistant visiting physician, 1941–, Hartford Hospital, Hartford, Conn. Fellow American Medical Association; associate American College of Physicians; member: New England Heart Association and American Federation for Clinical Research. Diplomate American Board of Internal Medicine.

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Young, Donald C., Commander (MC) USNR (*Failure of Type Specific Streptococcus Pyogenes Vaccine to Prevent Respiratory Infections*, p. 709). M. D., Wayne University College of Medicine, 1925. Intern, City of Detroit Receiving Hospital, Detroit, Mich., 1925–26; chief physician, 1926–40, and medical director, 1940–42 and 1495–46, communicable disease division, Herman Kiefer Hospital, Detroit. Member: American Medical Association, Michigan State Medical Society, Wayne County Medical Society, and Detroit Pediatric Society.

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EARLY OBSERVATION OF ANTIBIOTIC ACTION

In his book "Essays on the Floating-Matter of the Air" (1881), the physicist, John Tyndall, described experiments which he carried out in 1875 refuting the doctrine of spontaneous generation of life. In the course of these experiments tubes of organic infusions were infected with organisms after exposure to the atmosphere. A number of cases occurred when such tubes, which were turbid and swarming with bacteria, became covered with Penicillium glaucum, three unspecified kinds being noticed. The bacteria in these tubes lost their translatory power and fell to the bottom, leaving the liquid between them and the superficial layer clear. Tyndall ascribed this to the success of the molds in the struggle for existence and notes that access of oxygen to the body of fluid must have been hindered. He did not, however, test the clear liquid for its capacity to support newly implanted bacterial life. It is interesting to speculate upon what the consequences might have been had Tyndall allowed himself to be drawn from his main investigation.—DAVIES, C. N.: Early observation of antibiotic action. Nature 156: 666, December 1, 1945.

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JUNE 1946

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EDICINE AND SURGERY
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WASHINGTON, D. C.

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COVER PHOTOGRAPH

Medicine and surgery aboard a warship need not be in the rugged, hasty pattern in which it is so often visualized. These scenes from the U. S. S. *Yorktown* (upper) and the U. S. S. *Iowa* are veritable studies in tranquil convalescence. The medical officers, repectively, are Lieutenant Commander Frank B. Voris (MC) U. S. N. R. and Commander James A. Ward (MC) U. S. N. R.

—Official U. S. Navy Photos.

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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

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PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

With the establishment of the Dental Corps in 1912, the function of the BULLETIN was broadened to serve in a similar capacity for members of that Corps.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

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NOTICE TO CONTRIBUTORS

Contributions to the BULLETIN should be typewritten, double-spaced, on plain paper and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication; for example, addresses and dates, not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in headings and captions.

Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustration, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized. Recognizable photographs of patients should carry with them permission to publish.

All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

LOUIS H. RODDIS, *Editor,*
Captain, Medical Corps,
United States Navy.

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U. S. NAVAL MEDICAL BULLETIN

VOL. 46 JUNE 1946 NO. 6

SPECIAL ARTICLES

MALNUTRITION IN REPATRIATED PRISONERS OF WAR

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and
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On 29 August 1945, the U. S. S. *Benevolence* entered Tokyo Bay as a part of the U. S. Third Fleet and was immediately assigned the mission of evaluating the health of American prisoners of war being liberated from that area. On that night and during the succeeding 2 days, 1,520 repatriates were examined. Twelve hundred were considered well enough for evacuation by air or by transport. The clinical status of these patients varied. Some of the men appeared to be in almost normal health. Others showed signs of definite malnutrition, with minor degrees of edema, muscular wasting, or glossitis. The remaining 320 repatriates were considered ill enough to warrant further observation and treatment. All of those in this group had definite evidence of malnutrition.

With few exceptions the repatriates admitted to the sick list had been imprisoned for a considerable period of time in one of four detention centers, Camp Omori, Camp Ofuna, Shinegawa Hospital, or Kempi (Military Police) Headquarters in Tokyo. In all of them sanitary and dietary conditions were unsatisfactory.

Camp Omori, near the beach of Tokyo Bay, was registered with the International Red Cross and was considered by the Japanese to be a show place. Nevertheless, it appears to have been extremely insanitary. It had the highest incidence of prostrating, febrile dysentery

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(probably bacillary). The toilets consisted of apertures in the floor through which fecal matter dropped into a trench with concrete walls much like an American manure pit. The trench was sufficiently wide to extend beyond the outer wall of the building where it was covered with planks. By removal of one or more planks the partially decomposed fecal matter could be removed for use as "night soil" on adjacent garden patches. This increased the hazard of disseminating dysentery bacilli by flies and the risk of transmitting amebic cysts on the leaves of vegetables. Often the prisoners defecated on the floor before reaching a place upon which to relieve themselves, and the floor thus became contaminated. There were inadequate facilities for washing the hands, so undoubtedly direct contamination of the food also took place.

The diet at Camp Omori was representative of that of Japanese prison camps. The daily ration consisted of 600 grams of a mixture of unrefined rice, barley, and rye, supplemented at times by a few greens, clear soup, tea, or diminutive servings of fish approximately the size of large minnows. Working prisoners received about 700 grams of the basic grain diet. The intake varied, therefore, from about 2,100 to about 2,450 calories.

There were few complaints of extreme brutality from the prisoners who came from Omori. There were numerous fleas about the camp, but no lice were encountered. There was a moderate amount of medical care. In fact, on 15 August when peace negotiations were completed, a daily ration of vitamin pills was commenced. This was given not only to the prisoners who had been interned at the camp for a long period of months, but also to a group of fliers who were transferred at that time from Kempi Headquarters in Tokyo.

Camp Ofuna, situated several miles inland from Sagami Bay, and unregistered with the International Red Cross, was noted for the brutality of its guards, its deficient medical attention, and its fleas. Often on slight, if any, provocation from a prisoner, there were mass beatings administered to the buttocks and thighs with a 3-foot bamboo club. The basic diet at Ofuna, as at Omori, consisted of 600 grams of grain. Many of the prisoners, however, were assigned to working details outside the camp and succeeded in supplementing the diet by theft. Some of the stolen food was used to bribe the guards into overlooking this irregularity. Thus the prisoners from Ofuna, on the whole, were better nourished than those from Omori, and there appears to have been considerably less dysentery.

Shinagawa Hospital, near Tokyo, was the only military hospital in Japan with Red Cross supplies of vitamins and medicines. It consisted of lightly constructed frame buildings. The wards were furnished in Japanese manner, with mats on the floor instead of cots. These were placed in close proximity to one another around the pe-

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riphery of the room, leaving a free central area for dressing, eating, and other activities. The toilets, similar to those at Omori, consisted of holes in the floor. There was one bathtub indoors where each prisoner had a weekly bath. For washing the hands there was an out-of-door trough. A placard posted by an American physician divided this trough into two halves, one for prisoners with tuberculosis and the other for those free from the disease.

Perhaps because of the exigencies imposed on the Japanese by the extensive bombing of nearby Tokyo and Yokohama, this hospital was indescribably filthy. There were many fleas, and the patients slept in such close proximity to each other that the transmission of communicable diseases was inevitable. The basic diet, as at Omori and Ofuna, consisted of 600 grams of grain daily.

Kempi (Military Police) Headquarters in Tokyo was used for internment of B–29 fliers. Because of their supposed part in bombing civilians, these men were singled out for special punitive treatment. They were given half rations (300 grams of grain daily) and were denied all medical attention. Sixteen prisoners were assigned to each cell. The cells were about 11 feet long and 8 feet wide, and were partitioned with wooden gratings. Each cell had a small high window. In the corner of each cell was a commode, the container for which was removed for cleaning by an orderly who went under the building from the outside. Some of these orderlies were friendly to the prisoners and handed vitamin tablets to them through the commode apertures. Because of the commode in one corner and the small size of the cells, it was impossible for all the men to sleep at one time without lying on each other. There were many fleas. Some of the prisoners had draining wounds for which they could obtain no dressings. Nevertheless, owing to the external disposal of the sewage, there was almost no dysentery. The prisoners in Kempi Headquarters were transferred to Camp Omori on 15 August 1945.

Although during the months immediately preceding VJ-day most of the repatriates were in one or more of these places, there had been considerable variation in their treatment before that time. During the early years of the war some of the prisoners interned in Southern Japan had been afforded such luxuries as clean sheets. Many of the long-term internees had been "farmed out" to industrialists or to the railroads. These men had been fed relatively well and in addition had been able to steal additional quantities of food. Also in the early days some of the prisoners had been able to buy food. On the other hand, there were those who had been through the "March of Death" to Cabanatuan in the Philippines, and there were others who had spent as much as 30 days in the uncleaned holds of transports with the decks covered with feces and vomitus.

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CLINICAL FEATURES

Two sample groups of patients were selected for clinical analysis: (1) 25 B–29 fliers who, on the average, had been interned for from 6 to 9 months and had lost 44 pounds in weight; and (2) 28 other prisoners of war, who had been interned for an average period of 17.4 months and had lost 46 pounds in weight. All the patients retained on the U. S. S. *Benevolence* for treatment were screened before admission. There were 225 B–29 fliers who came aboard for screening, of whom 85, or 37 percent, were admitted to the sick list. Of 1,295 other persons who came aboard for screening, 235, or 10.8 percent, were retained. These figures indicate that the degree of disability of the B–29 fliers as a whole was much greater than that of the other personnel.

Physical condition of repatriated prisoners of war

	B–29 fliers	Other personnel		B–29 fliers	Other personnel
Average duration of internment (months)	6.9	17.4	Physical signs (percent):		
Average weight loss (pounds)	44	46	Wasting	84	78
Symptoms (percent):			Rice belly	80	68
Weakness	88	82	Glossitis	56	43
Diarrhea	64	78	Hyporeflexia	24	28
Edema (history)	44	68	Hypesthesia	12	25
Sore mouth	24	32	Nerve trunk tenderness	4	3.7
Incoordination	4	3.7	Hemoglobin (grams)	11.0	11.2
			Erythrocyte count (millions)	3.4	3.3

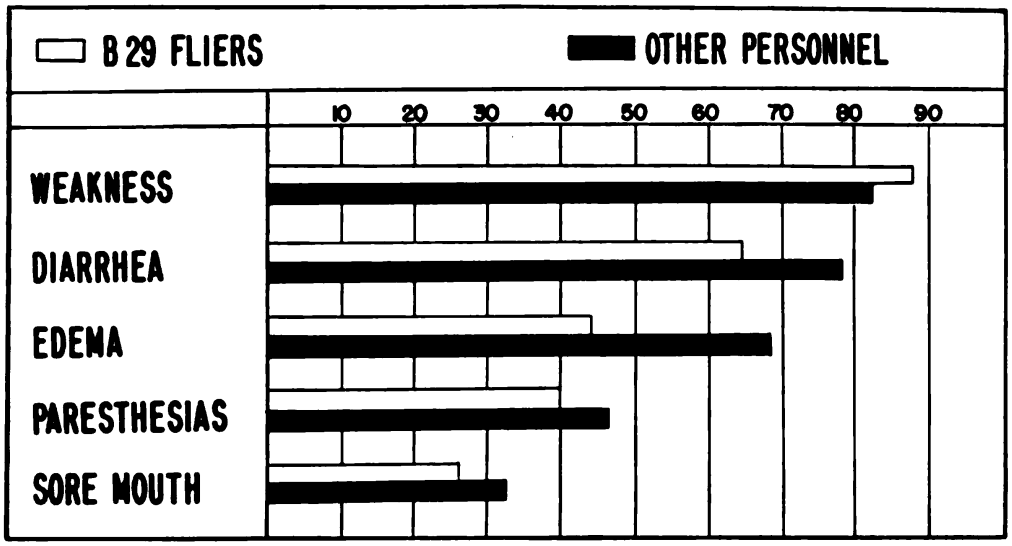
All the patients studied were on three adjacent medical wards under the care of the same professional personnel.[1] Before the patients were admitted a nutritional survey form had been devised, enumerating the principal symptoms and findings to be anticipated. These abnormalities were kept in mind during the history taking and physical examinations. The most important positive findings appear in the foregoing table and in figures 1 and 2.

The acute onset of symptoms of malnutrition could best be observed in the B–29 fliers. Many of these men had been shot down during the heavy raids of 25 and 26 May 1945 and had had 3½ months of internment at Kempi Headquarters on 300 grams of grain daily. On 15 August they had been transferred to Camp Omori where they had received vitamin therapy for 2 weeks before being received on this vessel. The patients of this group who were admitted to the sick list had lost from 30 to 70 pounds.

The earliest and most distressing symptom was weakness. Some of the men were so prostrated they could not stand up; others would

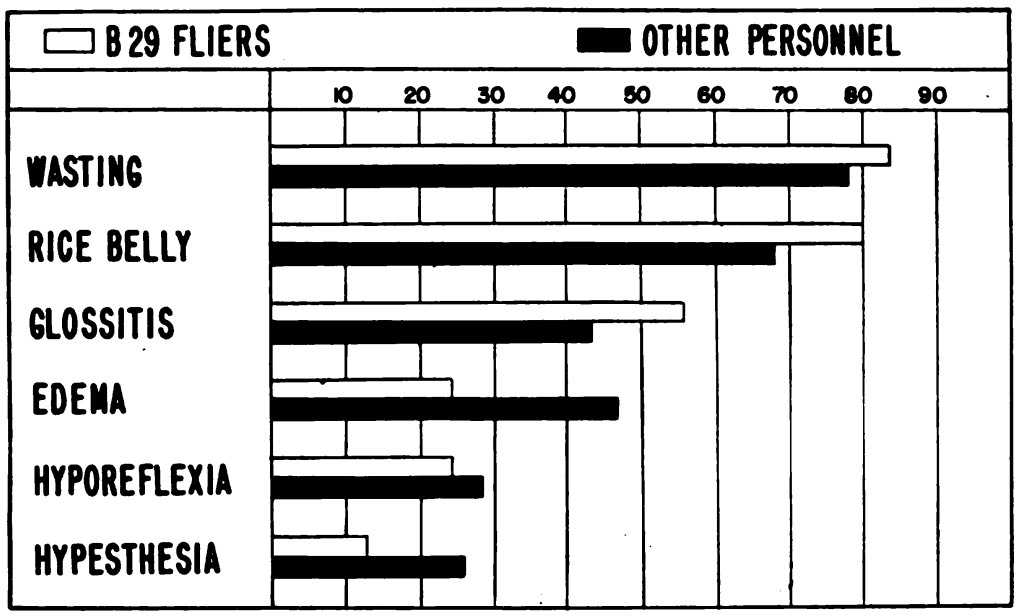
[1] In this work the authors were assisted by Lt. Mack L. Gottlieb (MC) U. S. N. R., Lt. (jg) Fennimore T. Johnson (MC) U. S. N. R., Surgeon Commander Hugh L. Cleave, R. N., and Surgeon Lieutenant Anthony D. Grove, R. N. V. R.

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1. Percentage incidence of symptoms of malnutrition in two groups of patients studied clinically. The minor differences between the two groups are of doubtful statistical significance.

become exhausted after the effort of folding a blanket. Next in importance were numbness, tingling, and pain. Such paresthesias were noted most often on the anterior aspects of the thighs and in the lower legs, but not infrequently in the back. Soreness of the mouth was described by 24 percent of the patients. Diarrhea was not prominent until transfer to Camp Omori on 15 August 1945. There



2. Percentage incidence of signs of malnutrition in two groups of patients studied clinically. The similar degree of disability in the two groups is attributable to the criteria used in selecting prisoners for admission to the wards. Of all the B–29 fliers whose state of nutrition was surveyed, 37 percent were admitted to the sick list whereas only 10 percent of the other personnel required hospitalization.

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it occurred in epidemic form and may have been bacillary in origin. This will be discussed further. Symptoms less frequently encountered are discussed in connection with the effects of malnutrition on the various systems of the body.

On physical examination most of the B–29 fliers were found to be extremely emaciated. The facies were drawn, giving a macabre appearance and masking the characteristic visage of the individual. The frontal bosses were prominent and the veins of the forehead stood out in relief. The subcutaneous tissue had been exhausted and marked wasting of the musculature was noted. This was maximal in the thighs, upper arms, and the abdominal wall. Indeed, many of the victims were reduced to "skin and bones." One of the most constant features was the "rice belly" which 80 percent of the patients demonstrated. The abdominal wall was almost paper-thin and flaccid yet distended by intestinal contents. A majority of the B–29 men showed bluish erythema of the tongue, with flattening of the papillae and a smooth surface, and many appeared larger than normal. Edema of the lower extremities was present in 24 percent of the aviators at the time of examination, but as many as 44 percent had had this finding at one time or another. Neurologic changes included grossly diminished or absent tendon reflexes, noted in 24 percent of the cases, and hypesthesia to touch, which was observed in 12 percent. Nerve-trunk tenderness was elicited in only a single instance. The mean hemoglobin was 11 grams, and the average red blood cell count 3,400,000.

The clinical features of the second series were more variable. The conditions under which these persons had been interned were less constant. Consequently there were several in the group who showed comparatively little evidence of malnutrition. On the other hand, many had been on deficient diets for a long period of time. A greater number had suffered from edema (68 percent) and from hypesthesias (24 percent). The classic signs of "wet" and "dry" beriberi were, therefore, more frequently encountered in this group. There were three men who had had bleeding gums, and several who had been aware of dimness or blurring of vision, or scotomata. The mean hemoglobin concentration was 11.2 grams and red blood cell count 3,300,000. The average weight loss and the state of tissue depletion was roughly similar in both series.

SPECIAL OBSERVATIONS

The patients studied clinically (B–29 fliers and others) constituted a representative sample of the repatriates admitted to the sick list of the ship. Other representative samples were studied by specialized clinical services or by laboratory examinations. These studies afforded a more detailed picture of the effect of malnutrition and avitaminosis on the various systems of the body.

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Eyes.—Forty patients were examined by the Ophthalmology Department to determine the integrity of the peripheral visual fields. External evidence of disease of the conjunctivae and of the corneae was also sought. Bitot spots, indicative of vitamin A deficiency, were observed in one B–29 flier who had been on bare subsistence for 13 months. Subjective photophobia was present in a number of instances, but no patient showed the conjunctivitis, pericorneal vascularization, or interstitial keratitis described as due to riboflavin deficiency. Slit-lamp observations were not made. The visual fields were contracted in all 140 patients. The ability to recognize color at the periphery of vision was particularly impaired. Eight patients were reported as being wholly unable to recognize green and one patient could recognize neither red nor green. In addition there were central scotomas of varying sizes in the majority of cases studied. Some of the optic disks were slightly pale but no other fundal abnormalities were noted.

Psyche.—On the night of 29 August 1945, when the first group came aboard, many of the repatriates were excited and euphoric. Their pupils were widely dilated. Later, when those who were admitted to the wards were studied more carefully, it was noted that they displayed an indifference toward their harrowing experiences. The psychiatrist expressed the view that this indifference was a manifestation of apathy, and he noted that the men were less boisterous than one would expect a healthy group of their age to be. Some of the men complained of what they called "Tokyo memory." They noted a spotty amnesia for both recent and remote occurrences. Several had amnesias for the events associated with their parachute jumps. Others could remember their children's faces but not their names. On the whole, however, there was little evidence of disorientation, and there were no confusional psychoses, or states of increased irritability or abnormal anxiety.

The absence of confusional psychoses or other profound mental disturbances can apparently be explained only on the basis that psychotic prisoners did not survive. There were several reports of prisoners who had been removed from their cells because of mental aberrations of one type or another. It is possible that they were neglected or killed. Many prisoners reported that cellmates had lost their will to live. They said that such a change in mental status was usually followed by anorexia, failure to eat, and starvation.

The oral cavity.—Fifty patients were examined by the Dental Department. Almost all showed bluish-red injection of the tongue, flattening of the papillae, and a rather smooth surface indicative of mild niacin deficiency. There was no instance of really severe glossitis, and although many had soreness of the tongue at the time of admis-

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sion, this was thought to be due to excessive smoking. The corners of the mouth were singularly free from cheilosis. There were no frank instances of spongy or bleeding gums suggestive of scurvy, although the interproximal papillae were often inflamed and bright red in color. There was surprisingly little evidence of Vincent's infection, and the amount of dental caries did not exceed that which would have been anticipated in a group of well-nourished persons.

Skin.—Dermatologic consultants took part in the screening of prisoners and in the care of patients admitted to the wards. No instance of pellagrous dermatitis was observed. One patient, who complained subjectively of chapped lips, had fine, scaly, somewhat crusted desquamation of the nasolabial folds, and a dry, corrugated, inelastic atrophy of the skin of the neck. It was believed that the lesions of the nasolabial folds might indicate a deficiency of riboflavin. Many patients were covered with bluish-bronze plaques of cutaneous erythema, indicating sites of previous insect bites. Numerous prisoners had observed the slow healing of cutaneous sores during their confinement. A striking observation was the absence of acne among the malnourished repatriates. This observation may give further evidence to support the belief that acne is in some way related to carbohydrate metabolism.

Cardiovascular system.—There was one patient who died shortly after admission with classic right- and left-sided congestive heart failure. This man had such great muscular weakness that he could neither swallow nor talk. In addition he had tachycardia, distant heart sounds, râles at the lung bases, orthopnea, edema, cyanosis, complete auriculoventricular dissociation and premature ventricular systoles. The electrocardiogram failed to show abnormal T waves or prolongation of the Q–T interval. The pathologic findings were typical of beriberi heart disease, including accumulations of fluid in the serous cavities, degeneration and edema of the myocardium, and marked dilatation of the right auricle.

With the exception of this one case, there was no patient with findings suggesting congestive heart failure. One patient, during the initial screening examination, had a gallop rhythm which promptly disappeared with rest and restored nutrition. Despite muscular weakness, dyspnea was not a common finding and in no case, except the fatal one described before, was orthopnea noted. The cardiac sounds were for the most part of excellent quality. Intravenous fluids were freely administered to the patients without evidence of left-sided heart failure.

Routine 6-foot heart roentgenograms were made on all the patients and failed to suggest right-sided cardiac enlargement in a single instance. The volume of radiographic work unfortunately precluded

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fluoroscopic examinations or special oblique views. Electrocardiograms were made in 50 cases. These showed a tendency toward the low voltage type of tracing, but in none did all the complexes register less than 5 millivolts. None showed inversion of the T waves in the first or second leads, and none showed prolongation of the Q–T interval.

Although the myocardium may well have been involved in many of the patients, there was little evidence of sufficient disease to produce significant congestive failure.

Gastrointestinal tract.—On arrival most of the repatriates had voracious appetites. An unsuccessful attempt was made to control overeating and although most of the patients tolerated large quantities of food without discomfort, a small percentage began to complain within 24 hours of abdominal fullness, distension, and cramping. On physical examination the abdomens of some of these individuals were tense and tympanitic with hypoperistalsis. Most of these symptoms and findings disappeared after limitation of food and water intake and the administration of simple enemas.

About 50 percent of the patients had severe watery diarrhea at the time of admission. Although 196 stool specimens were examined microscopically, there were less than 10 patients on the entire ship with proved amebiasis, which responded to therapy with emetine. There was a considerably larger number from Camp Omori who, on about 15 August 1945, had suffered from an epidemic of prostrating febrile diarrhea probably of bacillary origin. Stools from 50 of the more persistent ones were cultured on *Salmonella-Shigella* agar but no suspicious organisms were isolated. On the other hand there were several patients with cellular exudates characteristic of bacillary dysentery. None presented symptoms of ulcerative dysentery. Sigmoidoscopic examinations were not performed.

The management of diarrhea varied somewhat on the different wards. Most of the patients were given low-residue diets which they freely supplemented by visits to the general mess. Symptomatic medication, such as paregoric and bismuth, was employed in most cases. Half the cases of diarrhea subsided after about 3 days, and the great majority disappeared within 1 week.

Blood plasma.—Determinations of the plasma proteins by the plasma-specific gravity technic were performed in 16 patients with edema and 15 patients free from edema. Three of the edematous patients had concentrations below normal (5.0, 5.3, and 4.5 grams percent). In these the edema was attributed to hypoproteinemia. The remainder of these patients had protein concentrations between 6.5 and 8.4 grams percent. The mean concentration of the entire series, including the 3 low readings, was 6.8 grams percent. This compares with a mean concentration of 7 grams percent in the non-edematous

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subjects. Separate determinations of the albumin and globulin components were not made.

CLINICAL EVIDENCE OF SPECIFIC DEFICIENCIES

Fat.—There is no question from the weight loss and emaciation that the subcutaneous fat stores were depleted in most of the repatriates at the time of admission. The blood cholesterol concentration, which may be a comparative index of total blood lipids, is said to be depleted in starvation. Unfortunately there was no opportunity to perform this determination.

Protein.—According to Youmans (*1*) weakness is a predominant symptom of protein depletion. Marked asthenia was prevalent among the repatriates, as were edema and weight loss, both of which may result from deficiency of body protein. The extreme wasting of skeletal muscle also indicates protein lack. The comparatively normal plasma-protein concentrations would, at first, appear to contradict this. However, it is known that the plasma protein exists in a state of dynamic equilibrium and tends to maintain its concentration even with experimental variations in the blood volume (*2*). Moreover, White (*3*) points out that plasma proteins and the tissue proteins are independently synthesized from amino acids. The amino acids are therefore, the circulating reservoir from which both are derived.

Thus the plasma proteins are not the stock proteins of the body, nor do they even represent proteins in transit. Peters (*4*) states that when the body stores of protein are depleted by starvation, only 15 percent is lost from the plasma, the other 85 percent coming from other tissues. For this reason the plasma protein concentration is not a reliable guide to malnutrition. Conversely the amount of protein necessary to restore the plasma values to normal cannot be calculated from the deficit in the circulating blood. A much greater amount is needed.

Carbohydrates.—No studies were undertaken to show the effect of longstanding malnutrition on the liver. Undoubtedly the glycogen stores were grossly depleted much of the time, although temporarily restored following meals. Gross examination of the one liver available at autopsy showed marked atrophy. The right and left lobes were little more than an inch in thickness, and there was a yellowish color suggestive of fatty infiltration. The role of carbohydrate in offsetting the deposition of fat in the liver is well known, but there are other substances such as inositol, methionine, and choline which abet its effect. Moreover, Lund and Levinson (*5*) describe liver atrophy of this type as a manifestation of protein lack; hence, there is no conclusive proof that any permanent structural changes resulted from deficiency of carbohydrate.

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Vitamin A.—No dark adaptation tests or determinations of plasma vitamin A were performed. None of the patients complained of night blindness, which is generally considered to be the earliest manifestation of vitamin A deficiency. A careful search was made for Bitot spots—small triangular regions of cornification at the medial and lateral poles of the corneal limbi. These were seen in only one case, that of a B–29 flier who had been on extremely sparse rations for over a year. They represent the earliest epithelial change which results from deficiency of this vitamin. Photophobia was noted by a number of prisoners, but severe ocular manifestations such as keratomalacia and xerophthalmia were not encountered. Hyperkeratosis follicularis was also absent. Some vitamin A was doubtless afforded by the few green vegetables and the fish eaten by the prisoners. Moreover, as Luck (*6*) points out, the body stores of vitamin A are adequate for a long period of months. In general there was little evidence of vitamin A deficiency.

Vitamin B_1 (thiamine).—Deficiency of thiamine unquestionably played an important role in producing the paresthesias, hypesthesias, and reflex changes so often observed. It was probably responsible for most of the visual disturbances, particularly the constricted fields of color vision and the central scotomata. Rea (*17*) states: "Retrobulbar neuritis is found in some cases of beriberi, which is evidenced by the presence of a central scotoma for white and colors, but sometimes for the latter only. The peripheral fields of vision may show contraction. * * * From the occurrence of central scotoma it is obvious that atrophy of the papillo-macular bundle is sometimes found, but practically never a complete optic atrophy (Elliot)." Thus the nervous system showed ample evidence of thiamine lack. With the exception of one fatal case of congestive heart failure from a beriberi heat, there was less striking evidence of cardiovascular damage. The role of thiamine in producing hunger edema is discussed later.

Vitamin B_2 (riboflavin).—One of the patients in the B–29 flier group was noted to have areas of scaly erythema at the nasolabial folds. This is described as one of the characteristic features of riboflavin deficiency. There was a suggestion of magenta macroglossia in many cases, but little cheilosis, so that there was minimal evidence of ariboflavinosis.

Niacin.—There was no classic pellagra. Many of the patients had bluish-red injected tongues, with flattening of the papillae and smooth surfaces. In some instances these tongues were sore, although excessive smoking after liberation was undoubtedly a factor. The glossitis was undoubtedly the result of a mild deficiency of niacin. As previously noted, there were no confusional psychoses, and no examples of pellagrous dermatitis. Diarrhea was a prevalent symptom, but

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this may have resulted from infectious or other nutritional causes. These are discussed in a subsequent paragraph.

Pyridoxine.—It has been noted that in some cases of human vitamin B deficiency, complete recovery has not followed the use of crystalline thiamine, riboflavin, and niacin alone. There has been residual muscular weakness or evidence of central nervous system damage. In these cases pyridoxine is reported to have been effective. A very few of the patients observed by us gave evidence of neuromuscular incoordination on the heel to knee test, or had positive Romberg tests or Babinski's sign. It may be that some of these findings were due to lack of pyridoxine.

Pantothenic acid, biotin, inositol, paraminobenzoic acid.—Deficiencies of these substances, customarily considered to be components of the vitamin B complex, give rise to no symptoms or signs in human nutrition. There is consequently no clinical evidence on which to presume that the repatriates were suffering from a lack of them.

Vitamin C.—Although the blood concentration of ascorbic acid was not determined, it is certain that all the patients had suboptimal saturation of this substance. Full saturation requires from 80 to 100 milligrams daily (*7*), and the diets were obviously inadequate to furnish this amount. Although a few of the long-term prisoners stated that at one time or other they had had bleeding gums, at the time of admission there was no clinical evidence of scurvy. Apparently the diets consumed were at least adequate to prevent widespread suffering from this cause.

Pijoan and Lozner (*7*) recently experimented with six human subjects. These were saturated with ascorbic acid (400 to 500 milligrams daily for from 4 to 6 days) and then were placed on a diet lacking in vitamin C but adequate in all other respects. None developed scurvy until 5 or 6 months had elapsed. Gingivitis appeared only in one case. This experiment is certainly confirmed by the clinical observations made on our subjects.

Vitamins D, K, and E.—There was no clinical evidence of deficiency of any of these substances.

Extrinsic factor.—The hepatic hematopoietic factor necessary for the prevention of macrocytic anemia needs for its synthesis (a) an extrinsic factor which is present in yeast, beef, and other substances, and (b) an intrinsic factor secreted by the gastric mucosa. Pernicious anemia results from deficiency of the intrinsic factor, whereas deficiency of the extrinsic factor is one of the mechanisms which lead to sprue. None of the repatriates had classic sprue, but there were some manifestations of the disease which deserve comment.

Almost all of the patients had marked anemia. This was approximately normochromic (mean hemoglobin 11.1 grams; mean red blood corpuscle count 3,350,000; mean color index 1.05). The ane-

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3. Mess Hall of U. S. S. *Benevolence*. Here the repatriates ate enormous quantities of food despite initial efforts at restricting their diets

mia of sprue may be hypochromic and microcytic in the early stages, but is characteristically macrocytic when well established (*8*). The mean color index encountered among the repatriates is, therefore, not inconsistent with the anemia of sprue. The volume index would have been of value, but unfortunately volume indices were not available. The possibility that the anemias observed in the repatriates were related to sprue, or deficiency of extrinsic factor, gains strength from the fact that anemia is not described as a classic finding in any other deficiency disease except severe pellagra. The absence of characteristic mental or cutaneous findings excludes this possibility.

The distribution of muscular wasting and the protuberant soft abdomens (to which the prisoners referred as "rice bellies") were typical of sprue. Stitt's illustrations of wet beriberi show individuals with abdominal musculature of extraordinarily good tone whereas Hanes' (*8*) photograph of tropical sprue illustrates perfectly the flaccid protuberant abdomens seen among the malnourished prisoners.

Many of the prisoners had suffered from longstanding diarrheas, but the stools were not large and foamy as one would expect in sprue. There was no oral moniliasis. Glucose tolerance tests were not performed. The curve is flat not only in sprue, but also in other states of malnutrition, so would hardly have been of value in differential

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diagnosis. In short, there was no classic sprue syndrome, but a deficiency of extrinsic factor may well have contributed to the development of anemia, the selective muscular wasting, and the protuberant abdomens.

Management.—On arrival of the repatriates an initial attempt was made to give them comparatively light diets composed of readily digestible substances. It was feared that more substantial food would produce gastric and intestinal distension as well as other digestive disturbances. It was soon discovered, however, that the patients craved food and would eat several servings in spite of all efforts to prevent their doing so. Inasmuch as the voracious appetites of those fed first left nothing for the late comers, larger quantities of food were served (fig. 3). It was soon found that about 90 percent of the patients could eat 6 full meals a day supplemented by ice cream and chocolate bars without any untoward symptoms. The dietician estimated that the average repatriate took at least 5,000 calories a day, 15 percent being derived from protein, 40 percent from fat, and 45 percent from carbohydrates. The vitamin supplements varied somewhat on the different wards. A sample basic daily ration is as follows:

Vitamin A	15,000 units.
Vitamin B_1 (thiamine)	20 mg.
Vitamin B_2 (riboflavin)	10 mg.
(niacinamide)	60 mg.
Vitamin C (ascorbic acid)	225 mg.
Vitamin D	1,200 units

In addition 25 milligrams of intramuscular thiamine were given to all patients with neuropathies and 150 milligrams of niacinamide were administered to those with diarrhea. On other wards larger, rather than smaller, quantities were utilized.

Even with subsiding edema, the patients gained weight with amazing rapidity. In some cases 24 pounds were gained in as short a time as a week. The patients on whom this observation was made lost their edema during this time and their well-being increased tremendously. The neurologic signs and symptoms showed less rapid improvement, and most of the patients were transferred for air evacuation or to other vessels before much change was noticed.

COMMENT

Edema.—The standard literature on beriberi heart disease is largely based upon two sources: (1) Autopsy studies of oriental beriberi (*9*), and (2) clinical observations on malnourished alcoholics in city hospitals (*10*). The onset of cardiac failure is associated with changes in the nervous system, in the peripheral vascular system, and in the

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myocardium. The muscle of the heart often shows hydropic degeneration and an increase in intercellular substances. The cardiovascular disturbances, however, do not follow a rigid pattern. Right ventricular failure is most typical, but left ventricular failure, arteriolar dilatation, and peripheral circulatory collapse occur singly or in combination.

The "hunger edema" of inanition has been ascribed to thiamine lack causing congestive cardiac failure (*9*). In our series there was one autopsy of a case of typical beriberi heart with failure. There was one case of temporary gallop rhythm. Examination of all of the other patients with edema did not disclose any evidence of significant cardiac involvement. The 6-foot heart roentgenograms and the electrocardiograms showed normal findings in all the surviving patients. The patients did not have dyspnea, orthopnea, tachycardia, arrhythmia, or radiographic evidence of cardiac enlargement. It is apparent, therefore, that clinical and laboratory findings which might be interpreted as evidence of congestive failure were not encountered with sufficient frequency to explain the edema on that basis.

Serum albumin is the most important protein factor in the maintenance of the osmotic pressure of the circulating plasma. Globulins make a lesser contribution. Measurement of the total plasma proteins indicated hypoproteinemia in only three instances. Most of those with edema had normal protein values. Thus no correlation between the total plasma protein and the edema could be made.

Estimation of the plasma albumin might have detected a significant number of cases of hypoalbuminemia. In inanition albumin is the first protein to be depleted after stored tissue protein (*11*). Regeneration of albumin from endogenous or exogenous protein is a complicated and sometimes retarded process. A more rapid globulin manufacture might have compensated for depletion of albumin and so obscured the essence of the deficiency. Furthermore as the plasma albumin falls and transudation occurs, there may be a reduction of plasma volume (*1*). These variable factors have the effect of making a quantitative measurement of the total protein in the plasma of the malnourished patient an unreliable measurement of the actual albumin deficit.

The relative roles of thiamine and proteins in the treatment of hunger edema is not clear (*12*). Among the malnourished repatriates thiamine hydrochloride was not specific in relieving the edema even in cases where the total plasma protein was normal. This observation is in accord with the similar experiences of Youmans (*1*), Raynaud and Laroche (*13*), and Gounelle, Bachet, and Marche (*14*). In association with a protein-rich diet, however, thiamine undoubtedly contributes to the disappearance of edema. In fact Simonart (*15*) states

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that thiamine alone causes hunger edema to disappear. If thiamine plays an important role this may be related to an increased peripheral capillary bed as suggested by Weiss and Wilkins (*10*). This may contribute to edema formation by exposing the hydrostatic pressure of the arterioles to a larger area of capillary endothelium or by an actual increase in capillary permeability as suggested by Krogh (*16*).

Protein hyper-alimentation, plasma infusions, and blood transfusions had a quicker beneficial effect in relieving edema among the evacuated war prisoners than did large parenteral doses of thiamine hydrochloride. This was noted in some patients who had been receiving it in daily doses of 50 milligrams. Many of them showed no subsidence of edema until 200 grams of protein hydrolysate orally, blood, or plasma were given as a supplement to the high protein diet.

Some of the patients became edematous after coming aboard. This was despite a high intake of both protein and thiamine hydrochloride. A liberal intake of fluids and the ingestion of normal amounts of salt seemed to be a factor. The physical economy had been adjusted to a poor salt intake during months of deprivation. Recovery from edema was hastened when, in addition to the other measures, the salt intake was restricted to less than 5 grams and the fluid intake to 2 liters.

Digestive symptoms.—Gastro-intestinal disturbances, especially alterations in bowel function (diarrhea and constipation), are among the commonest manifestations of vitamin deficiency. In the absence of pellagrous dermatitis and fatty stools characteristic of sprue, it was not possible to be specific in classifying the diarrheas as expressions of unitary dietary deficiencies. Specific therapy with parenteral liver extract was not employed, so that its therapeutic effect could not have been a factor in the rapid recovery which was observed in most of the cases. However, the "rice bellies" resembled those seen in the typical cachexia of sprue. The restoration of the stools to normal consistency within a short period of time without large amounts of specific therapy indicated that the total nutrition was related to the diarrhea. The diarrhea thus, appears to have been the result of multiple dietary deficiencies. In every case of diarrhea shigellosis and amebiasis were considered.

Adaptation to deficient diet.—The repatriates under consideration had subsisted on varying types of diets. All the diets were inadequate according to recommended standards. The majority of the prisoners had lived on a mixture of grains, consisting of unrefined rice, rye, and barley. Fish, breadstuffs and a few green leaves boiled in water were occasionally added. It is apparent that several factors were deficient: notably protein and extrinsic factor. There were also sub-optimal amounts of vitamin A, thiamine, vitamin C, and vitamin D. The presence of these substances in small amounts, however, may explain

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the relative absence of more specific symptoms and signs of avitaminosis. The repatriates, who had subsisted on prison rations of the worst sort, did not show evidence of typical vitamin A deficiency, ariboflavinosis, sprue, pellagra, or scurvy. The absence of such avitaminoses raised the question whether the minimum daily requirements of many vitamins might not be lower than generally recommended.

It is common knowledge that frank nutritional disease was not common in Great Britain during the war, even though the average diet for years was well below recommended standards. Some nutritional standards may be needlessly high.

Among the patients studied on the *Benevolence* were a number of rugged and aggressive individuals who had been in prison camps for as long as 3 years. Their ability to do hard work had gained for them jobs on road projects and farms. These men took food when they could find it. They foraged in freight cars containing sacks of grain and thus supplemented their issued rations. Most of them showed little evidence of malnutrition. The answer to their comparative well-being was found in their acquisitive habits.

The condition and survival rate of the much larger group of prisoners who had not foraged were harder to determine. The survivors among them appeared to have made a selective adaptation to their limited diets.

The capacity of the organism to adjust gradually to low levels of intake is still unproved. The effect of sudden and rapid withdrawal of nutritional essentials in precipitating severe states of malnutrition has not been studied in humans, and the question of adaptation is not answered by the uncontrolled study of these prisoners. However, it seems justifiable to theorize that vitamin and other nutritional requirements have been placed too high, and that humans do adapt themselves to abnormally low levels of nutritional intake.

SUMMARY AND CONCLUSIONS

1. One thousand five hundred and twenty repatriated prisoners of war were examined aboard the Navy hospital ship U. S. S. *Benevolence*. Of these, 320 were admitted to the sick list because of physical disability. The remaining repatriates with minor degrees of disability not requiring hospitalization were immediately evacuated to the United States on transports.

2. Fifty-three of the repatriates admitted to the sick list were studied clinically and their symptoms and signs of malnutrition were tabulated. All had been on deficient diets.

3. In most of the prisoners there was clinical evidence of multiple dietary deficiency, but none of the syndromes indicated classic beriberi, pellagra, scurvy, or sprue. The absence of these clinical enti-

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ties suggests that the usual standards of vitamin requirements may be too high.

4. Hunger edema was one of the most puzzling findings. In only one case could this be traced to right-sided congestive heart failure. In general there was no response to thiamine hydrochloride alone, but extra protein rations, casein hydrolyzates, and intravenous blood and plasma gave prompt relief.

5. Despite the dramatic response of edema to protein restoration, the total plasma proteins were found to be depleted in only three instances.

6. The clinical findings of the patients indicated definite deficiency of the vitamin B complex, extrinsic factor, and protein. On the other hand there was little indication of deficiency of vitamins A, C, D, E, or K, or of essential minerals.

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OBSERVATIONS AND DATA ON PREVENTION OF POISON-OAK DERMATITIS

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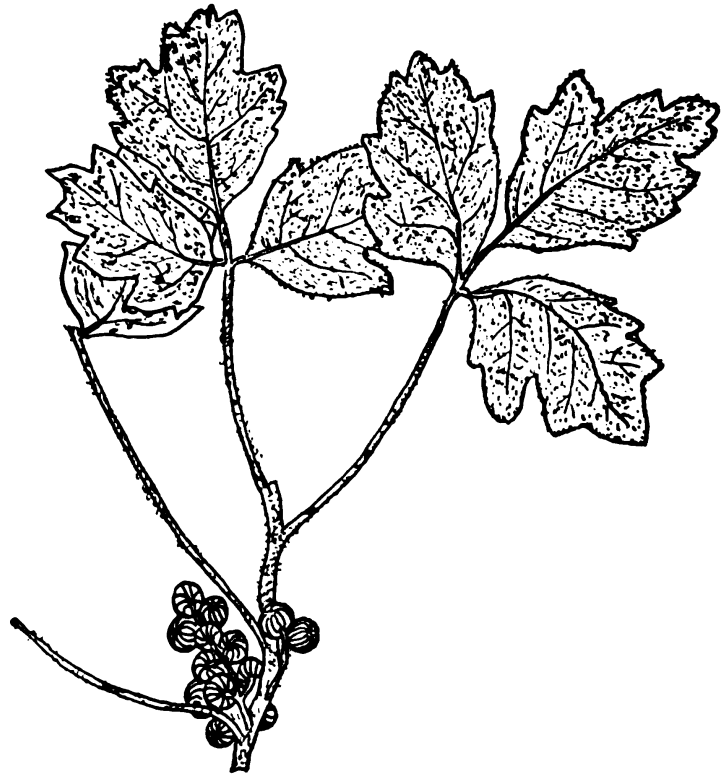
Poison-oak dermatitis has occurred to such an extent that it constitutes one of the major causes for time lost from training at Pre-Flight School, St. Mary's College, California.

Poison oak, as it is known on the West Coast (poison ivy, *Toxicodendron diversiloba*) grows in the form of vines or low erect bushes and is able to adjust itself to varied environmental conditions. It is found along the coastal area in southern Canada, Washington, Oregon, California, and the northwestern portions of Lower California. In California it is found from the foothills of the Sierra Nevada range to the coast. Little of the plant is found in the Sacramento or San Joaquin valleys, it being present rather in the foothills, the valley streams, mountain slopes, and mountain valleys. Little of the plant is found above 4,000 feet, and 5,000 feet is generally agreed to be about the highest elevation at which it grows. There is less growth in the arid regions with none growing in desert areas, and optimum condition for growth is in those areas in which the rainfall is from 20 to 40 inches per year. The shrubs are 4 to 8 feet high and do not show a great tendency to climb; in redwood forests, however, areas of high rainfall, the stems may grow to a height of about 75 feet. The leaves which begin to come out in March are divided into three leaflets, lobulated or non-lobulated, which are arranged alternately on simple stems. Familiarity with one of the forms of *Toxicodendron* should make it possible to recognize any of the various types. There have been numerous classifications and synonyms but in general the classifications emphasize three types of poison ivy which seem basically the same species with no fundamental difference between them.

The following is the classification of Kuntze as adopted by the United States Herbarium in Washington, D. C., and has been used by Spain (*2*):

1. *Toxicodendron toxicodendron* (*Toxicodendron quercifolium*) (found in central states).
2. *Toxicodendron radicans* (eastern ivy).
3. *Toxicodendron diversiloba* (poison oak found in West Coast area).

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Poison Oak. (*After Britton and Brown.*) This type of poison ivy is commonly referred to as poison oak, the reason being the very definite oak-like leaf which gives it the specific botanical name "quercifolia" or "oak-leaf" poison ivy. It is a *Rhus* and in no way an oak or in any way related to the oaks. This type of poison ivy has a number of names among botanists most of which refer to the oak-like leaf or to the fact that it remains a rather small shrub, or a recumbent vine.

The present evidence (*2*) (*1*) indicates that the allergenic oleoresins from the different types of poison ivy, Japanese lac trees, and poison sumac are identical and that successful immunization with an extract from any one should provide protection against any of these plants. Shelmire demonstrated that the ingestion by 11 persons of 1 ounce each of 1:100, 1:50, and 1:25 dilutions of the oleoresin of *Toxicodendron radicans* over a period of 8 months resulted in hyposensitization of these persons to all 4 species, including *Toxicodendron vernix* or poison sumac, where previously all had been sensitive to dilutions of 1:1000 or higher.

Measures for control of poison dermatitis should consider the possibility of eradication of the plants (*3*) by means of application of ammonium sulfamate solution (using ¾ to 1 pound of the chemical to 1 gallon of water), Diesel oil, sodium chlorate solution or powder, the jar method employing a solution of 1 percent arsenic trioxide, and the removal of plants by digging them up. The first three agents described destroy other plants, and organic material when mixed with

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sodium chlorate is highly inflammable and easily ignited; it should not be used in the summer.

Parenteral administration.—Parenteral administration of ivy antigens is thought by many workers, among them Clarke and Hanna (*4*) and Molitch and Poliakoff (*5*) to confer a practical degree of clinical immunity in the majority of subjects. The number of injections administered varied from 4 to 20.

After having administered these injections it was noted there were fewer cases of dermatitis after casual exposure in the field among those having received the injections than among controls. It has been noticed however that there is no lessening of the reaction (*6*) (*7*) to the patch test following the parenteral administration of the antigen which strongly suggests that such a person would contract poison-oak dermatitis following a sufficient exposure.

Prophylaxis with oral antigens.—The results of investigation (*8*) (*6*) (*9*) indicate that hyposensitization and desensitization as demonstrated by both the patch test and trial in the field may be best achieved by the oral administration of the poison oak residue in a sufficiently large dose. This state of immunity or partial immunity when confirmed by patch tests appears to be a temporary one, being of 5 to 6 months' duration. With the present available means this method appears to be the one of choice for conferring the greatest degree of protection against the irritant of the ivy plants. Shelmire (*6*) recommended that the total dosage in an average case should comprise about 2 cc. of an ivy leaf oil dispensed in 1-ounce bottles of 1:100, 1:50, and 1:25 dilutions and administered over a period of 8 or 9 months. Gold and Masucci (*9*) gave an initial dose of 0.5 mg. of ether-extracted ivy residue and gradually increased the dose until at the end of 45 days the daily dose was 150 mg. Ten of this group of 20 were desensitized, 6 hyposensitized, and the remaining 4 were unaffected. Approximately 3 grams of the residue were consumed by each person. Eighty percent developed skin reactions, usually in the first 2 or 3 weeks, varying from localized or diffuse erythema to vesiculation with edema and desquamation, particularly of the fingers. If the treatment was continued despite skin reactions gradually increasing doses were tolerated by the patients. If the reactions are severe the medication may be discontinued (*10*) for a few days and then started again using the last dose rather than a smaller one. Very large oral doses of the oleoresin given orally over a period of months were apparently tolerated without any demonstrable damage to the individual as indicated by a normal blood pressure, urinalysis, blood count, and general physical examination.

Characteristics of oleoresin.—The evidence (*2*) from the investigations of (a) Majima and associates, (b) Foyama, (c) Hill, Mattacotti,

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and Graham indicates that the active agent in ivy is a nonvolatile oil called urushiol which is apparently quite similar or possibly identical in all forms of ivy, sumac, and Japanese lac trees. It is a benzene compound with formula of $C_{21}H_{32}O_2$. Ether or acetone appear to be the preferable solvents for urushiol rather than alcohol or carbon tetrachloride (*11*) as the resulting solutions when the first two are employed are more allergenic. This allergenic resin is quite stable (*13*) and deteriorates very slowly. A solution of oleoresin in ether showed no loss of potency after remaining in a stoppered bottle for 5 years at room temperature. Squares of cotton cloth contaminated by rubbing with crushed leaves were allergenic after 1 year. Poison ivy extract mixed with water showed only slight reduction of activity after 17 months. There is some evidence that dried lacquer from Japanese lac trees containing urushiol resisted complete oxidation for centuries (*2*). It was demonstrated that the handling of equipment used on hikes in areas where poison oak is present resulted in poison-oak dermatitis in sensitive individuals. Of the many chemicals tried there apparently has not been any satisfactory agent which readily destroys the poison oak allergen and which can be used in prophylaxis of ivy dermatitis. Howell (*12*) states that 10-percent potassium permanganate solution prevents or diminishes the severity of the dermatitis if applied within the first 15 minutes after exposure. In highly sensitive persons washing with 10-percent potassium permanganate solution 15 or more minutes after exposure did not lessen the severity of the rash. Thorough washing with soap and water after contact with the irritant and the pre-exposure application of petrolatum. 10-percent ferric chlorite or 10-percent sodium perborate ointment did not prevent ivy dermatitis. Several drugs, including calamine, magnesium oxide, lead acetate, ferric chloride, and alkaline hydrogen peroxide were tested (*13*) to determine their chemical actions on the resin. Of these only alkaline hydrogen peroxide inactivated the resin. The resin retained its irritating properties after being mixed with the other chemicals. Ten-percent sodium perborate ointment (*14*) apparently offers little protection and the benefit if any seems mechanical in nature. Sodium perborate was found, after repeated testing, not to inactivate the resin.

Experimental data.—Experiments were performed to reduce the amount of poison-oak dermatitis through the use of a topical agent which could be quickly and easily applied when needed either in the form of an ointment or solution rather than by attempting mass desensitization of known susceptibles which would prove technically difficult. Chlorinated lime, described in the U. S. Dispensatory as a chemical compound best represented by the formula CaOCl(Cl), associated

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with varying amounts of calcium hydroxide and moisture is an oxidizing agent which exerts a powerful action on organic matter and volatile oils. This agent and a Navy antigas protective ointment were tested for their efficacy against the ivy resin.

Thirty individuals with known definite susceptibility to poison oak were patch tested in the manner described next. Most of these individuals had had a recent attack of poison-oak dermatitis.

1. Acetone solution of the poison oak extract, 1:200, was placed on the volar surface of the forearm and the area covered with gauze which was held in place by adhesive tape. The gauze and tape were removed after 24 hours and the patient was observed daily for several days as occasionally delayed reactions occurred. Most reactions had fully developed by the third day. All of the patch tests, using various materials and combinations, were done in a similar manner and left on for 24 hours. Following these tests all individuals had strongly positive reactions with vesiculation, the area of involvement measuring from ¾ to 1 inch across. These and other reactions with vesiculation were treated by breaking the blisters with an alcohol saturated gauze sponge, applying a solution of 20-percent tannic acid and 1-percent phenol and covering the areas with gauze dressings.

2. Navy antigas protective ointment was applied to the skin followed by 1:200 poison oak extract in acetone. The 30 individuals all had areas of erythema from ¾ to 1 inch across except 3 individuals who had reactions with a small number of vesicles, 4 to 6. This inflammatory process of mild to moderate degree subsided after 5 to 6 days without any treatment.

3. A mixture of Navy antigas protective ointment and poison oak extract in a concentration of 1:100 was applied to an area on the arm about ¾ inch in diameter. The reaction was quite similar to test 2 with a resulting erythema similar in size and degree.

4. Eighteen individuals were tested with Navy antigas protective ointment alone as a control with a resulting area of erythema of the same size as in tests 2 and 3 but of less intensity. This area usually faded away more quickly than the tests in which poison oak was also used. This ointment was irritating to the skin if the area of application was covered with gauze for 24 hours.

5. Poison oak extract was mixed with zinc oxide ointment so that final concentration contained 1:100 of the oleoresin. Following application of this mixture in 10 individuals there was a resulting reaction with vesiculation equal in degree and in some instances involving an area larger than the reactions in tests using the 1:200 solution alone. More than 10 individuals were not tested because of the consistency of the reaction and the undesirability of much dermatitis in men in an active program.

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6. Twenty cubic centimeters of the 1:200 solution of poison oak extract in acetone was mixed with 3 grams of chlorinated lime and 20 cc. of water. A vigorous reaction followed with very active bubbling and churning; after the process subsided 20 cc. of ether were added, the contents thoroughly mixed and the ether removed by a pipette. The ether mixture was then used for patch testing. Ten individuals were tested with only one slight reaction of redness about 3 to 4 mm. across while the others were negative without any signs of irritation.

7. Ten-percent sodium perborate ointments (*15*), formulas I and II, were used on 8 individuals and followed with 1:200 poison oak extract in the usual manner with positive reactions with vesiculation in all cases but of approximately one-fourth to one-third the size of the control in which 1:200 poison oak extract was used alone.

8. Ten-percent sodium perborate ointment, formula I, when mixed with 10 percent chlorinated lime was followed by a vigorous reaction with liberation of gas. This combination was considered unsatisfactory. Formula II (*15*) was mixed with 10-percent chlorinated lime with no resulting reaction and patch tests were done on 20 individuals applying the ointment first and following with a 1:200 acetone solution of poison oak extract, with only 3 slight areas of redness measuring a few millimeters across, the others being negative without any signs of irritation. Ointment number II has the following formula:

Cetyl alcohol	35.1
Stearyl alcohol	5.3
Ceresin	3.5
Castor oil	20.8
Mineral oil	21.9
Duponal WA pure	1.7
Sodium perborate	10
Boric acid	.7

9. In seven subjects the 1:200 extract of oleoresin was applied, left on for 10 minutes, and the area washed with a saturated chlorinated lime solution. Five-percent chlorinated lime by weight was added to the water, the mixture agitated, and the clear upper fluid used for the washing. Of the seven tests there were only two with small areas of redness without vesiculation while the rest of the group had no reaction.

10. The application of poison oak extract 1:200 to the skin was followed by 10-percent chlorinated lime ointment 10 minutes later in several cases. The reactions were small areas of redness without vesiculation in the majority of cases. The remaining group was negative.

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11. Two grams of urea hydrogen peroxide, an effective oxidizing agent, were mixed with 10 cc. of 1:200 poison oak extract in acetone and 10 cc. of water. A mild reaction with a moderate amount of bubbling followed. The mixture was permitted to stand for 10 days and the oleoresin then extracted with 10 cc. of ether. On patch testing with this ether solution the reactions were fully as strong as before, indicating no loss of potency.

In a group of individuals whose complement averaged essentially the same for 1944 and 1945, there were the following sick days in the hospital due to dermatitis venenata: March 1944, 61, March 1945, 9 (14 percent); April 1944, 146, April 1945, 45 (23 percent). The number of sick days was greatly reduced in 1945 apparently by use of the Navy antigas protective ointment. Among the patients in the sick bay in March and April 1945 only 1 cadet had used the ointment but not to his face where he was afflicted. The remaining persons had not used the ointment. No individual in this series who had applied the ointment prior to exposure contracted a severe case of poison oak dermatitis. There were many who had small patches of poison-oak dermatitis but no one among those using the ointment as directed was incapacitated because of the dermatitis. The patches of dermatitis in these individuals did not show its usual tendency to spread.

From the above information it is suggested the Navy antigas protective ointment is an effective ointment in the prevention of ivy rash. The ointment afforded protection even when the allergen was mixed into the ointment and then applied. This ointment however is irritating to the skin. Although no serious reactions resulted, most individuals had some erythema where it had been applied. The ointment composed of 10-percent chlorinated lime in formula II, alone or with the poison oak resins, which proved the most effective in the patch tests and furthermore not irritating to the skin, was not given a field trial as there was not sufficient material available. From the patch test this would appear to be the most effective agent. It proved effective in preventing or greatly modifying the dermatitis even when applied 10 minutes after the application of the oleoresin to the skin.

There were groups of individuals who took regular 4-hour hikes twice weekly into country in which poison oak was plentiful and following this exposure some of the groups were instructed to use a chlorinated lime solution as a rinse to areas of the body usually involved by the dermatitis. The solution was placed in containers in the shower room and was used after disrobing but before going into the shower baths. The impression gained was that the cases of poison oak dermatitis among those using the rinse were more mild and did not tend to spread as much as the ordinary cases without protection. This however is a field trial and is not an exact method. The inactivation

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of the oleoresin by chlorinated lime suggests the use of this agent for decontamination of articles contaminated by the ivy resin. Certain articles of clothing and gear could readily be washed or sprayed with a chlorinated lime solution. The chemical is inexpensive, relatively stable when dry, and easily prepared for use. As both Navy antigas protective ointment and chlorinated lime are effective against the resin it is suggested that chlorinated lime in turn may be effective against vesicant gases and that a solution of chlorinated lime could well be used for decontamination of the individual, except for the eyes, and for various exposed articles to which the gas tends to adhere. A fresh solution could be used either as a wash or spray.

Both Navy antigas protective ointment and the 10-percent chlorinated lime ointment offer protection which is not due to mechanical action but which is due to the destruction or inactivation of the ivy resin. These ointments to be most effective should be applied to the skin before exposure.

No protection was noted when the resin was mixed with zinc oxide ointment.

There was consistent modification of the dermatitis with the use of the 10-percent sodium perborate ointment as recommended by the United States Public Health Service but no one was completely protected by the ointment and this protection may well have been mechanical in action.

The chlorinated lime solution prevented the dermatitis when used 10 minutes after the application of 1:200 ivy extract and completely inactivated the resin when mixed with it. This was demonstrated by extracting the resin from the mixture with ether and then using the ether extract for skin testing. The tests were negative indicating a destruction of the oleoresin.

CONCLUSIONS

1. The various types of poison ivy are fundamentally the same.
2. The oleoresin in poison ivy, poison sumac, and Japanese lac trees is identical.
3. Hyposensitization to the ivy resin is best achieved by the use of large doses of oral antigens rather than by parenteral administration of the resin.
4. Urea hydrogen peroxide does not inactivate the ivy oleoresin.
5. Navy antigas protective ointment inactivates the ivy oleoresin and protects the user against ivy dermatitis.
6. Chlorinated lime inactivates or destroys the ivy oleoresin and protects the user against ivy dermatitis if used in ointment form prior to exposure.
7. Ten-percent chlorinated lime in a special formula is more effective than Navy antigas protective ointment.

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ACKNOWLEDGMENT.—The author extends sincere thanks to Captain C. C. Troensegaard (MC) U. S. N. R., whose cooperation and understanding made possible these experiments and this article.

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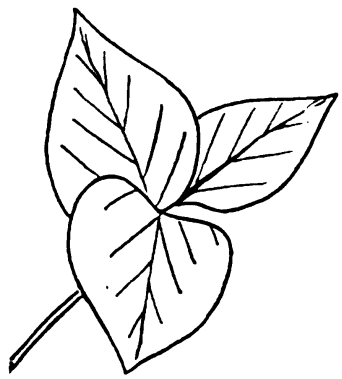
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DIFFERENCE IN CHARACTERISTICS OF POISON IVY AND VIRGINIA CREEPER

"Poison Ivy" (After Britton and Brown)



Three leaves. "Leaves three—Let it be."

Climbing vine, woody when large.

Edge of leaf smooth.

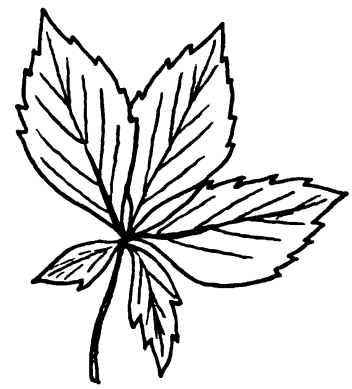
Leaf stalk: none or very short.

Berries are small, flattened globes, smooth, and gray.

Leaves highly colored in fall (scarlet and gold). Yellow often predominates over the scarlet color.

Grows best in well-drained soil.

"Virginia Creeper" (After Britton and Brown)



Five leaves.

Stem succulent.

Edge of leaf serrated; larger than that of poison ivy.

Has definite leaf stalk.

Berries globular, smooth, and blue in color.

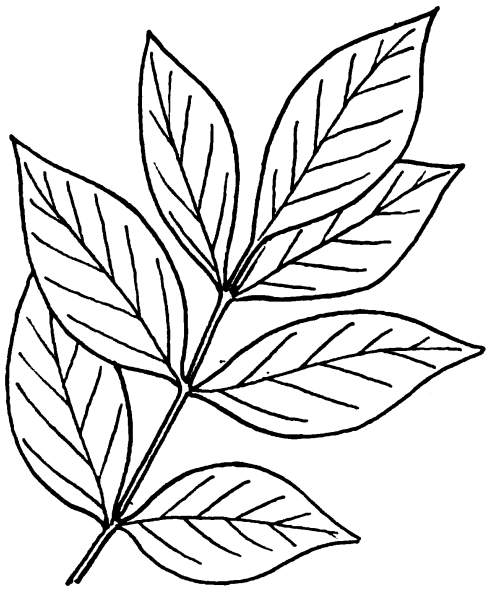
Leaves in autumn vivid scarlet color, little or no yellow.

Upland plant, grows best in well-drained soil.

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DIFFERENCE IN CHARACTERISTICS OF POISON SUMAC AND SCARLET SUMAC

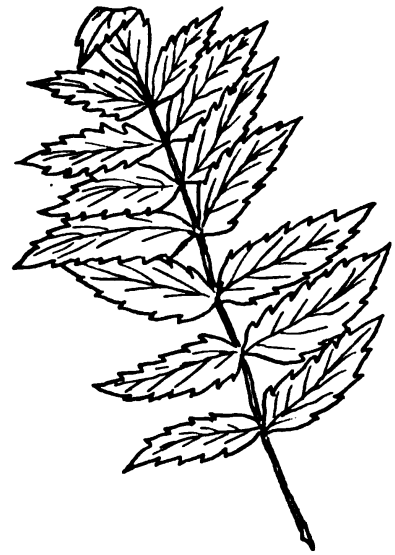
"Poison Sumac" or "Swamp Sumac" (*After Britton and Brown*)



Three leaves. "Leaves three—Let it be."
Shrub or small tree.
Fruit round, oblong, gray, smooth.

Leaves do not change color in autumn.
Found in wet and swampy ground.

"Scarlet Sumac" (*After Britton and Brown*)



Leaves narrow and serrated, arranged in pairs along stem.
Shrub or small tree.
Fruit scarlet and covered with short reddish hairs.
Leaves turn deep red in autumn.
Upland plant, grows best in dry soil.

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COMPARATIVE EVALUATION OF PREPARATIONS FOR THE PROPHYLAXIS AND TREATMENT OF FUNGOUS INFECTIONS OF FEET

MARION B. SULZBERGER
Captain (MC) U. S. N. R.
and
ABRAM KANOF
Commander (MC) U. S. N. R.

The great practical importance of discovering better prophylactic agents for fungous infections [1] of the feet impelled the Research Division of the Bureau of Medicine and Surgery to extend its efforts along these lines beyond the point described in previous communications. The study reported in this paper was undertaken at Hart's Island during the summer of 1945 (*1*) to add further data to the previously reported studies on antifungous agents (*2*) (*3*); and to test additional substances for their efficacy in the prophylaxis of fungous infections of the feet.

INCIDENCE OF FUNGOUS INFECTION

Because of the great interest in the incidence of fungous infections throughout the world, we report our findings on incidence of fungous infections at Hart's Island, New York, in the summer of 1945. A total of 1,152 men was examined routinely in order to find subjects for the nine prophylactic series. They were drawn without selection from the station complement of young male prisoners, and those with clinical infection were rejected from the prophylactic series and observed in the therapeutic studies. Results of initial examinations were as follows:

I. *Definite clinical signs of infection of the feet*

	Men
1. Very mild degree of infection	85
2. Mild, moderate, and severe infection	78
Total men with clinical infection (14 percent)	163

[1] Throughout this communication the term "fungous infection" is used to indicate those findings commonly attributed to that disease. For purposes of this experiment it was not thought that mycologic studies were necessary.

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II. *Minimal evidence of infection of the feet*

	Men
1. Scaling	356
2. Maceration	126
3. Both scaling and maceration	114
Minimal evidence of infection (52 percent)	596

COMPARISONS OF PROPHYLACTIC POWDERS, MATERIALS AND METHODS

The present study again included the two most promising materials of the previous studies, i. e. undecylenic acid-zinc undecylenate powder and calcium propionate powder. In addition, the present studies included thiourea powder and diodoquin powder because recent in-vitro investigations (*4*) (*5*) indicated that these agents may possibly have an important antifungous function. Vioform powder was included because of its well established lack of irritancy and great usefulness in treating certain eczematoid and eczematous skin lesions (Manual of Dermatology), and because of its chemical similarity to diodoquin. Foot powder, U. S. N. (general issue) and plain talcum powder were included as controls.

In this series of experiments the previously described Hart's Island method of paired comparisons was again employed (*2*). It was felt that the simultaneous use of two different medicaments, each on one foot of the same subject offered the best possibilities for direct comparisons of efficacy.

The following are the formulas of the various agents used in this study:

1. *Undecylenic-acid-zinc undecylenate powder*[2] *(pigmented)*

Zinc undecylenate, W & T	20.0
Talc, U. S. P.	76.0
Undecylenic acid, Grade AA	2.0
Dibenzo-thio-indigo (red)	2.0

2. *Sopronol powder*[3]

Calcium propionate	15.0
Zinc propionate	5.0
Polychloro-copper-phthalocyanine (green)	.5
Talc, U. S. P.	79.5

3. *Diodoquin powder*[4]

Diodoquin	5.0
Talc, U. S. P.	95.0

[2] Supplied by Wallace & Tiernan Products, Inc., Belleville, N. J.
[3] Supplied by Mycoloid Laboratories, Inc., Little Falls, N. J.
[4] Supplied by G. D. Searle and Co., Chicago, Ill.

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4. *Vioform powder* [5]

(a) Vioform powder	1.0
Talc, U. S. P.	99.0
(b) Vioform powder	3.0
Talc, U. S. P.	97.0

5. *Talcum powder*

Purified talc, U. S. P.	100.0

6. *Foot powder, U. S. N., Contract #140S–14632A*

Sodium bicarbonate, U. S. P.	10.0
Sodium borate, U. S. P.	5.0
Kaolin, N. F.	35.0
Purified talc, U. S. P.	38.0
Sodium perborate, U. S. P.	10.0
Titanium dioxide	1.0
Chlorthymol, N. F.	.5
Methyl salicylate, U. S. P.	.5

7. *Thiourea powder*

Thiourea	5.0
Purified talc, U. S. P.	95.0

8. *Undecylenic acid-undecylenate ointment* [6] *(pigmented)*

Undecylenic acid, grade AA	5.0
Triethanolamine	3.0
Zinc undecylenate, W. & T.	18.0
Propylene glycol, N. F.	10.0
Carbowax, 1500	19.0
Carbowax, 4000	29.6
Water, distilled	15.0
Dibenzo-thio-indigo (red)	.4

In general, the methods employed and the precautions taken were the same as those reported for the 1944 experiment (*1*) (*2*). The powders used on the right and left foot, however, were paired as follows:

Group I (May 15 to September 15)

Series A: Undecylenic powder [7] vs. no treatment.
Series B: Undecylenic powder vs. calcium propionate powder.
Series C: Undecylenic powder vs. talcum powder.
Series D: Undecylenic powder vs. thiourea 5 percent in talcum.
Series E: Undecylenic powder vs. foot powder, U. S. N.

[5] Supplied by Ciba Pharmaceutical Products, Inc., Summit, N. J.
[6] Supplied by Wallace & Tiernan Products, Inc., Belleville, N. J.
[7] This abbreviated term is used instead of undecylenic-acid-undecylenate powder.

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Group II (July 15 to September 15)

Series F: Vioform powder, 1 percent and 3 percent in talcum vs. no treatment.
Series G: Foot powder, USN vs. no treatment.
Series H: Calcium propionate powder vs. no treatment.
Series J: Diodoquin, 5 percent in talcum vs. no treatment.

Tests included in Group I were begun on May 15, 1945. All of the subdivisions (or series) of this group remained practically intact for two months. After that period of time men were withdrawn at a varying rate from all subdivisions, but observations were continued on those who remained.

Tests included in Group II were begun on July 15, 1945, and the four series remained intact for 2 months. The exception to this was Series J, which was started late due to difficulties in procurement of materials and was therefore observed for only 1 month.

All of the men who participated in these tests were subjected to examination of the feet at the beginning of the study and thereafter once each week. Not only were definite clinical evidences of infection noted, but also minimal manifestations, such as slight maceration and scaling. As stated in the footnote on page 822, the term "fungous infection" was used only to indicate those symptoms and signs commonly attributed to fungous infection of the feet. It was considered impractical, and for the purposes of this experiment unnecessary, to confirm the clinical diagnosis by demonstration of fungi.

SIDE EFFECTS

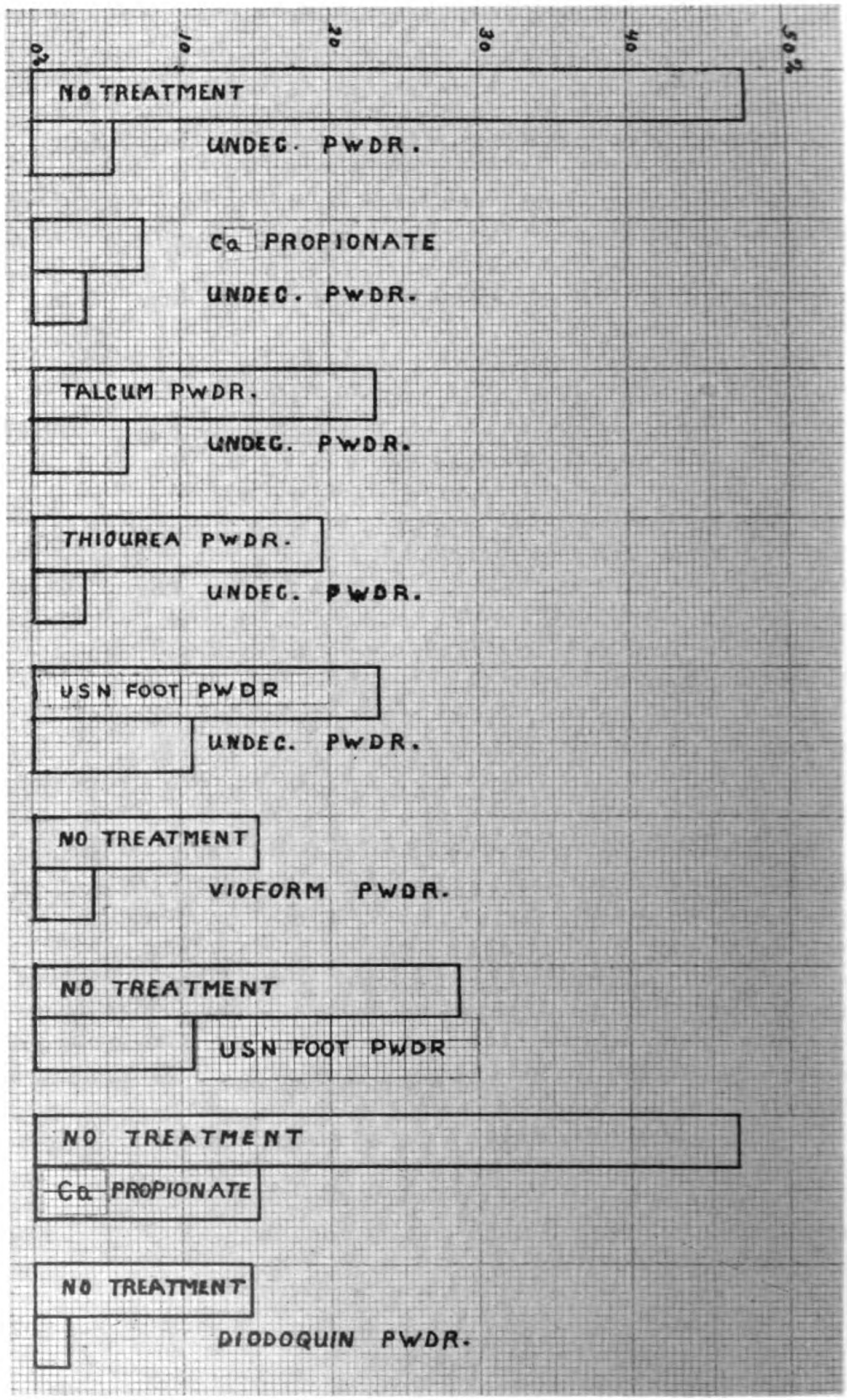
During the weekly examinations the men were asked about burning, lumpiness, and other possible undesirable effects of the treatment or qualities of the powder. Complaints of "burning" were about equally distributed for all the powders, and were never serious enough to warrant discontinuing their further use. There were a few complaints about the odor of the undecylenic powder, particularly when there was a concentration of the powder because several men using it happened to occupy the same section of the barracks. No significant complaints of lumpiness were encountered.

One man developed a slight dermatitis due to the thiourea powder. No other case of dermatitis was noted.

We attempted to gather objective evidence of the irritancy of these agents by patch testing with them at the beginning of the experiment. The results were as follows:

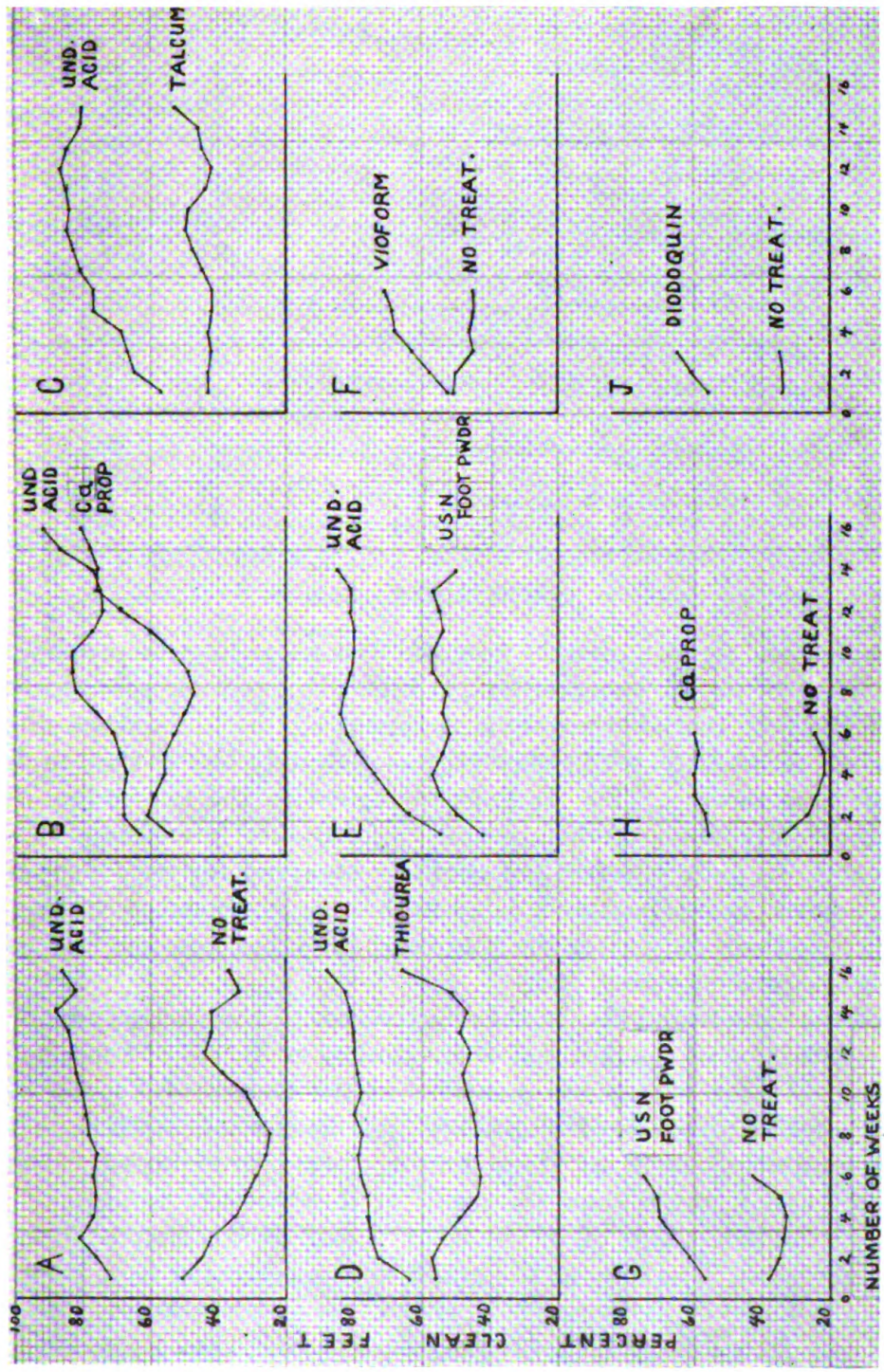
Powder used	+	±	0	*Total*
Undecylenic	1	24	339	364
Calcium propionate	0	5	191	196
Talcum	1	0	93	94
Thiourea	0	0	74	74

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1. Percentage of feet with clinical signs of infection while under treatment with the different prophylactic agents.

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2. Percentage of men in prophylactic series who evidenced lack of minimal infection while on the various powders.

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TABLE 1.—*Number of infections occurring in the nine series*

Group	Series	Total number infections	Total number feet	Percent developing infection
I	A. Right foot: Undecylenic powder	6	107	5.6
	Left foot: No treatment	51	107	47.7
	B. Right foot: Undecylenic powder	4	106	3.8
	Left foot: Calcium propionate powder	8	106	7.5
	C. Right foot: Undecylenic powder	7	108	6.5
	Left foot: Talcum powder	25	108	23.1
	D. Right foot: Undecylenic powder	4	107	3.7
	Left foot: 5-percent thiourea powder	21	107	19.6
	E. Right foot: Undecylenic powder	12	111	10.8
	Left foot: USN foot powder	26	111	23.4
II	F. Left foot: 1-percent and 3-percent vioform powder	5	118	4.2
	Right foot: No treatment	18	118	15.3
	G. Right foot: USN foot powder	13	119	10.9
	Left foot: No treatment	34	119	28.6
	H. Right foot: Calcium propionate powder	16	105	15.2
	Left foot: No treatment	49	105	46.7
	J. Right foot: 5-percent diodoquin powder	2	82	2.4
	Left foot: No treatment	12	82	14.6

RESULTS

Table 1 and figure 1 give the essential data regarding the prophylactic efficacy of the various powders. Undecylenic powder again proved to be the best available prophylactic agent against dermatophytosis. Calcium propionate, while efficient, was definitely less so than undecylenic acid powder. The findings in regard to the two iodine-containing compounds—diodoquin and vioform—are interesting. They appear to be quite effective but could be observed for only comparatively short periods because a delay in their procurement permitted us to include them only after the studies of the other powders had been going on for some time.

We were interested also in the effectiveness of the various agents in the elimination of the minimal or subclinical evidences of fungous infection. In the weekly examinations of the feet careful notes were made of the presence of slight scaling, maceration, and fissuring. Feet exhibiting none of these findings were pronounced "clean." Table 2 and figure 2 show the result of these weekly notations. In figure 2 the percentage of incidence of "clean" feet is charted against time in weeks. The lines on the graph were constructed from running means obtained by averaging the percentages of our successive weekly periods. It will be seen that undecylenic powder kept a greater percentage of feet entirely clear of evidence of infection than did any of the other agents with which it was compared. However, daily application of any of the powders appeared to be significantly more effective than no application at all.

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TABLE 2.—*Occurrence of subclinical evidence of infection in the men observed on the prophylactic series*

	Agent used	Week of observation																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Number of men observed		107	106	106	104	96	99	102	96	88	83	71	67	53	48	38	25	17	9	5
Series A percent of rt. ft. clean.	Und. ac	61	61	88	79	75	82	73	74	78	79	79	79	81	88	84	84	94	67	100
Series A percent of lt. ft. clean.	No treat	60	54	56	34	36	41	30	21	25	26	28	37	38	52	47	32	35	22	60
Number of men observed		106	105	99	94	103	99	99	96	84	60	42	22	18	15	13	7	6	4	4
Series B percent of rt ft. clean.	Und. ac	47	64	68	70	71	64	63	78	77	85	88	82	78	60	77	86	83	100	100
Series B percent of lt. ft clean.	Ca prop	47	71	62	51	62	59	50	53	48	48	40	59	67	73	77	86	67	80	100
Number of men observed		108	104	101	87	82	77	79	73	71	65	62	61	53	38	31	26	21	17	
Series C percent of rt. ft. clean.	Und. ac	49	63	68	49	82	70	73	81	85	83	81	92	79	87	90	81	66	82	
Series C percent of lt. ft. clean.	Talcum powder	42	47	38	43	42	44	42	40	42	55	53	49	40	32	48	58	47	59	
Number of men observed		107	103	107	97	85	66	64	59	55	41	42	42	35	..	30	30	28	26	2
Series D percent of rt. ft. clean.	Und. ac	39	58	77	83	73	68	81	81	80	75	76	88	72	..	80	87	75	88	100
Series D percent of lt. ft. clean.	Thiourea	41	57	64	63	45	42	45	42	42	46	48	43	52	..	43	53	46	65	100
Number of men observed		111	111	93	93	91	91	88	85	80	78	74	71	70	60	50	41	41		
Series E percent of rt. ft. clean.	Und. ac	39	53	68	68	67	77	85	87	80	85	78	81	77	83	82	83	92		
Series E percent of lt. ft. clean.	U. S. N. foot pdr	31	32	47	59	63	52	55	44	55	60	51	60	58	48	54	66	73		
Number of men observed		118	91	87	87	90	84	75	69	70										
Series F percent of rt. ft. clean.	No treat	51	66	34	51	50	44	37	48	52										
Series F percent of lt. ft. clean.	Vioform	47	52	43	66	70	71	64	69	79										
Number of men observed		119	114	109	106	102	92	82	72	71										
Series G percent of rt. ft. clean.	U. S. N. foot pdr	53	52	53	70	68	72	68	75	86										
Series G percent of lt. ft. clean.	No treat	45	38	32	37	33	33	28	44	66										
Number of men observed		105	104	112	103	80	70	68	65	59										
Series H percent of rt. ft. clean.	Ca prop	58	56	52	57	62	67	54	52	66										
Series H percent of lt. ft. clean.	No treat	50	39	26	20	24	26	19	18	36										
Number of men observed		82	...	71	60	63	61													
Series J percent of rt. ft. clean.	Diodoquin	54	...	53	62	67	76													
Series J percent of lt. ft. clean.	No treat	46	...	28	28	46	36													

SEVEN-DAY TEST SIMULATING COMBAT CONDITIONS

In order to test the prophylactic efficacy of undecylenic powder and of 5 percent diodoquin powder under conditions resembling those frequently found in combat zones, a group of 73 men had their right feet treated once with the former and their left feet treated once with the latter agent, and then wore their footgear continuously for 7 days. The feet, socks, and shoes were well powdered with the respective agents. After the socks had been put on and the shoes laced, adhesive tape was used to seal both the laces and the tops of the shoes. Neither socks nor shoes were removed in the 7-day interval. All of the feet were examined at the beginning and at the end of the 7-day period.

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None of these men had signs of clinical infection at the beginning of the study. At the termination of the week, the findings were as follows:

1. Three of the feet treated with diodoquin powder developed definite signs of fungous infection.
2. One foot treated with the undecylenic powder developed definite signs of fungous infection. This man's other foot was 1 of the 3 which developed the infection while on diodoquin.
3. Seventy men started with uninfected feet and had uninfected feet at the termination of the experiment.
4. Of 31 feet with minimal manifestations of infection (scaling, maceration), 14 (45 percent) improved after a week of treatment with undecylenic powder.
5. Of 36 feet with minimal manifestations, 13 (36 percent) improved on treatment with diodoquin.

In addition 23 men with definitely infected feet were selected for this 7-day experiment. Twelve of these had infections on both feet. The diodoquin powder, undecylenic powder, socks and shoes were applied as described in the 7-day prophylactic experiment. Results were:

1. In 8 men both feet improved to a like extent.
2. In 2 men there was no improvement in either foot.
3. In 1 man the foot treated with undecylenic powder cleared up during the week, while the diodoquin-treated foot did not.
4. In 1 man the foot treated with undecylenic powder showed no improvement. In this same man, however, the diodoquin-treated foot became worse during the week.

There were 11 men in whom 1 foot was infected while the other was not, making paired comparisons impossible. Of 4 feet treated with undecylenic powder, 3 cleared up and 1 showed no improvement. Of 7 feet treated with diodoquin powder, 4 improved while 3 remained the same.

Summary

	Undecylenic Powder	*Diodoquin*
Total number of feet treated with one application of 7 days	16	19
Total improved	12 (75%)	12 (63%)
Total no change	4 (25%)	6 (32%)
Total worse	0	1 (5%)

It is apparent that, with groups of the size employed in experiments 2 and 3, no significant difference in the prophylactic and therapeutic efficacy of undecylenic and diodoquin powders could be demonstrated.

THERAPEUTIC TESTS OF POWDER VS. OINTMENT

In order to decide whether there was any need for both a powder and an ointment on the supply catalog, a small therapeutic experiment was set up. Since the powder form was obviously the most suitable for

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prophylaxis, the experiment was designed chiefly to ascertain whether an ointment or a powder was the more effective form of applying treatment with the undecylenic acid-zinc undecylenate mixture. The results of treatment of 70 men in whom both feet showed an equal degree of infection were as follows:

1. In 15 men the feet treated with the ointment healed on the average about 1 week earlier than those treated with the powder.
2. In 9 men the feet treated with the powder healed on the average 1⅓ weeks earlier than those treated with the ointment.
3. In 44 men, healing time was the same with both powder and ointment.
4. In 2 men the experiment was not continued to healing.

In addition to these paired comparisons a total of 43 feet where there was no basis for comparison with the mate were treated. On the average, improvement was noted in 0.85 week and cure was effected in 1.35 weeks. In 15 men similarly treated with the powder, the average time needed for improvement was 0.83 week and for cure, 1.57 weeks.

ACCURACY AND VALUE OF THE METHOD OF PAIRED COMPARISONS

This series of experiments again substantiated the accuracy and value of the experimental screening method elaborated at Hart's Island. The value of the method is especially brought out by the close correlation of the figures for two successive years by the same method:

Agent used	Percent incidence of infection		Percent by which incidence of infection was reduced compared to no treatment	
	1944	1945	1944	1945
Undecylenic powder	1	5. 6	88. 5	88. 2
Propionate powder	3	15. 2	65. 5	67. 2
No treatment	8. 7	47. 0		
Best agent	Undecylenic powder			

Further evidence of the value of the method is the close correspondence of these figures with those reported by Shaw (*6*) (*7*) in a larger number of men observed in a field experiment. These figures were:

	Percent
Reduction of incidence of infection by treatment with undecylenic powder	93. 3
Reduction of incidence of infection by treatment with propionic powder	71. 3

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There was close correlation between our experimental findings and the clinical results reported by Shaw. However, by use of the paired comparison method, 7 different powders were tested by employing approximately 1,000 men during a period of 4 months. In the clinical study where comparisons had to be made between groups of men using the same agents on both feet, 5,000 men and a period of 6 months were required to study only 4 substances.

SUMMARY AND CONCLUSIONS

1. At Hart's Island during the summer of 1945, the general incidence of fungous infections of the feet was ascertained by routine clinical examinations. In an unselected series of 1,152 men who had no complaints, there was an incidence of clinically apparent infection in 14 percent. Only 34 percent of the 1,152 men had feet entirely clear of minimal evidence of infection.

2. Further studies by paired comparisons on men confirmed the previous findings and clinical evidence that undecylenic powder is the most effective, practical, and acceptable of the agents investigated for use in the prophylaxis of fungous infections of the feet.

3. This powder was also superior in the maintenance of freedom from even the minimal or "subclinical" evidences of infection.

4. It was also evident that there are other agents of distinct value and that any nonirritating regime which involves a greater consciousness of foot hygiene and the daily use of a foot powder will materially reduce the incidence of fungous infections.

5. In experiments where men kept their shoes and socks on continuously for 7 days, it seemed that perhaps undecylenic powder was better than diodoquin powder, both prophylatically and in the treatment of mild degrees of infection.

6. Our studies could establish no significant differences in the efficacy of undecylenic powder and undecylenic oinment in the treatment of mild to moderate foot infections. The undecylenic powder was found to be almost free of untoward effects in ambulatory patients.

7. Further evidence was adduced that the method of "paired comparisons" on symmetrically situated areas of skin of the same individual is a useful and accurate means for rapid evaluation of the relative properties of dermatologic medicaments intended for external application. This statement is supported by the facts that when the method was used repeatedly in 2 successive years, the results with the same agents were always identical or closely similar, and were on the whole very closely analogous to the results obtained elsewhere with more tedious and time-consuming clinical studies on large numbers of men.

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TREATMENT OF GONORRHEA IN WOMEN

Commercially produced sodium penicillin, administered according to identical time dose schedules, is as efficient in the treatment of gonorrhea in women as in men. No difference in response to treatment can be demonstrated in different races. No naturally penicillin-fast strain of gonococcus has been encountered nor any indication of the development of penicillin fastness under treatment. With sodium penicillin, which is now available, a 4-hour treatment schedule suitable for use by private physicians and clinics has proven satisfactory.—THOMAS, R. B. and MEYER, E.: Penicillin in treatment of gonorrhea; results with six hundred seventy-five women. Ven. Dis. Inform. 26: 94–98, May 1945.

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DIAGNOSIS OF INFESTATION WITH "SARCOPTES SCABIEI" VAR. "HOMINIS"

DISCUSSION OF LIFE CYCLE OF ORGANISM

EUGENE A. HAND
Lieutenant Commander (MC) U. S. N. R.

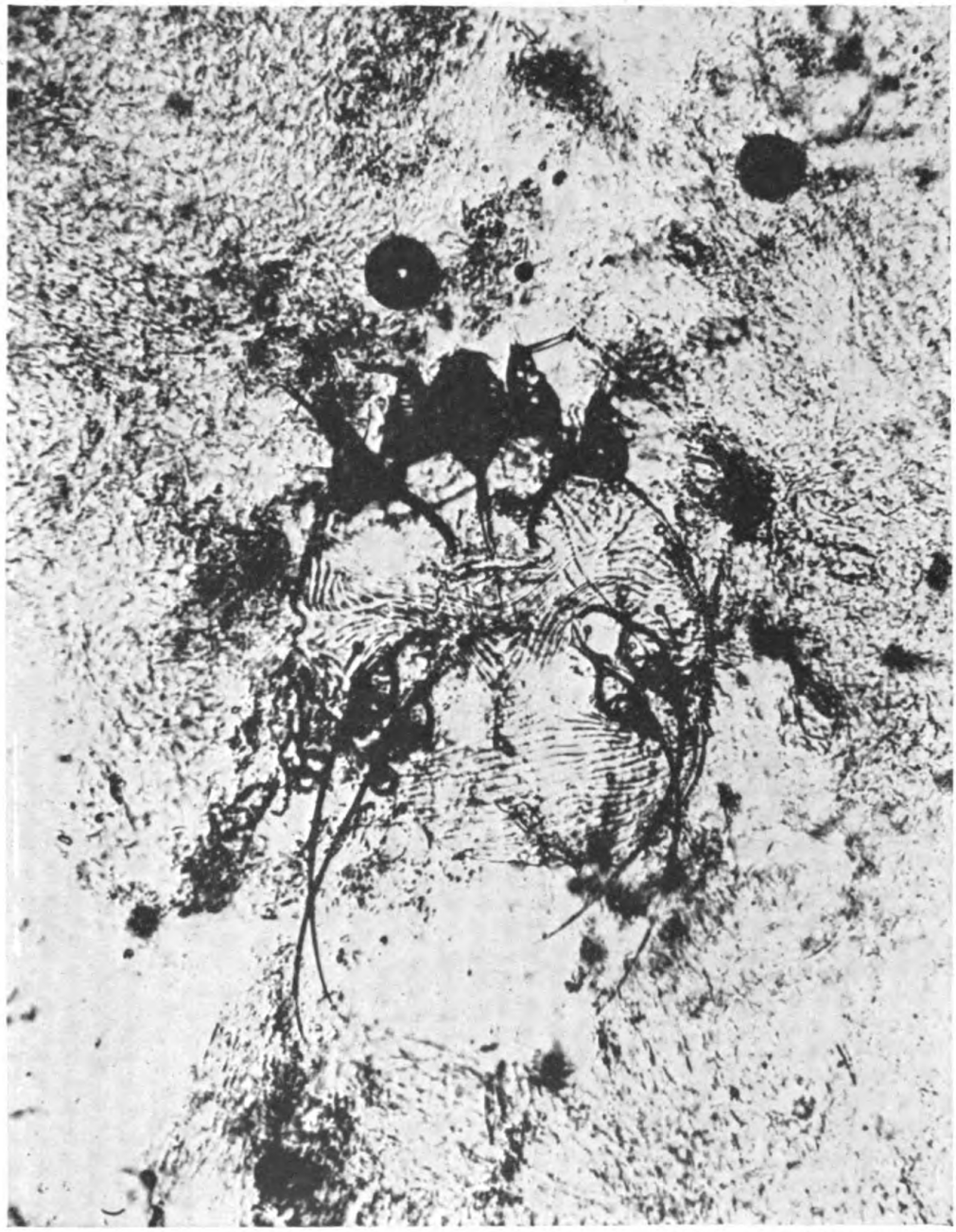
Bonomo (*1*), of Leghorn, Italy, in 1687 described the *Sarcoptes scabiei* var. *hominis* after teasing the female adult out of a scabetic burrow or vesicle on the point of a needle or pin. This has been the classical method of finding the acarus and is so described in most old and modern books on diseases of the skin. In Freidman's (*2*) poem written to celebrate the 250th anniversary of this discovery, the difficulty of finding the acarus is likened to the search for the pot of gold at the end of the rainbow. From this the author does not feel alone in never having found the acarus by this method.

As a liaison officer in charge of the dermatology and syphilology department of a large Australian Army Base hospital, the diagnosis and treatment of scabies was an important part of my work with the members of the various allied forces and also prisoners of war in that area. Benzyl-benzoate, when obtainable, was the treatment of choice for scabies. A 25-percent mixture of benzyl-benzoate in calamine lotion applied twice a day for 5 days from the neck down was curative in a large number of cases. Untoward reactions from its use were seen in less than 1 percent of those so treated. We do not share the optimism of those who report almost 100 percent cure from one application.

These reactions were of the same type though milder than those seen from benzocaine and picric acid. This was a dermatitis medicamentosa type of eruption secondary to absorption. The lesions were seen as multiple, small, very inflammatory vesiculo-pustules with a follicular distribution. The reaction tended to be persistent. A true dermatitis venenata type of eruption was seen in no case.

As benzyl-benzoate was at times unobtainable, other antiscabetic compounds were used. These included precipitate of sulfur, styrax, oil of cade, balsam of Peru, betanapthol, pyrethrum powder, D. D. T. powder, and sodium thiosulfate followed by weak hydrochloric acid. Precipitate of sulfur, being the most lethal to the acarus, and always at hand, was by far the most commonly used of these.

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—*Official U. S. Navy Photo.*

1. Ventral view female adult acarus.

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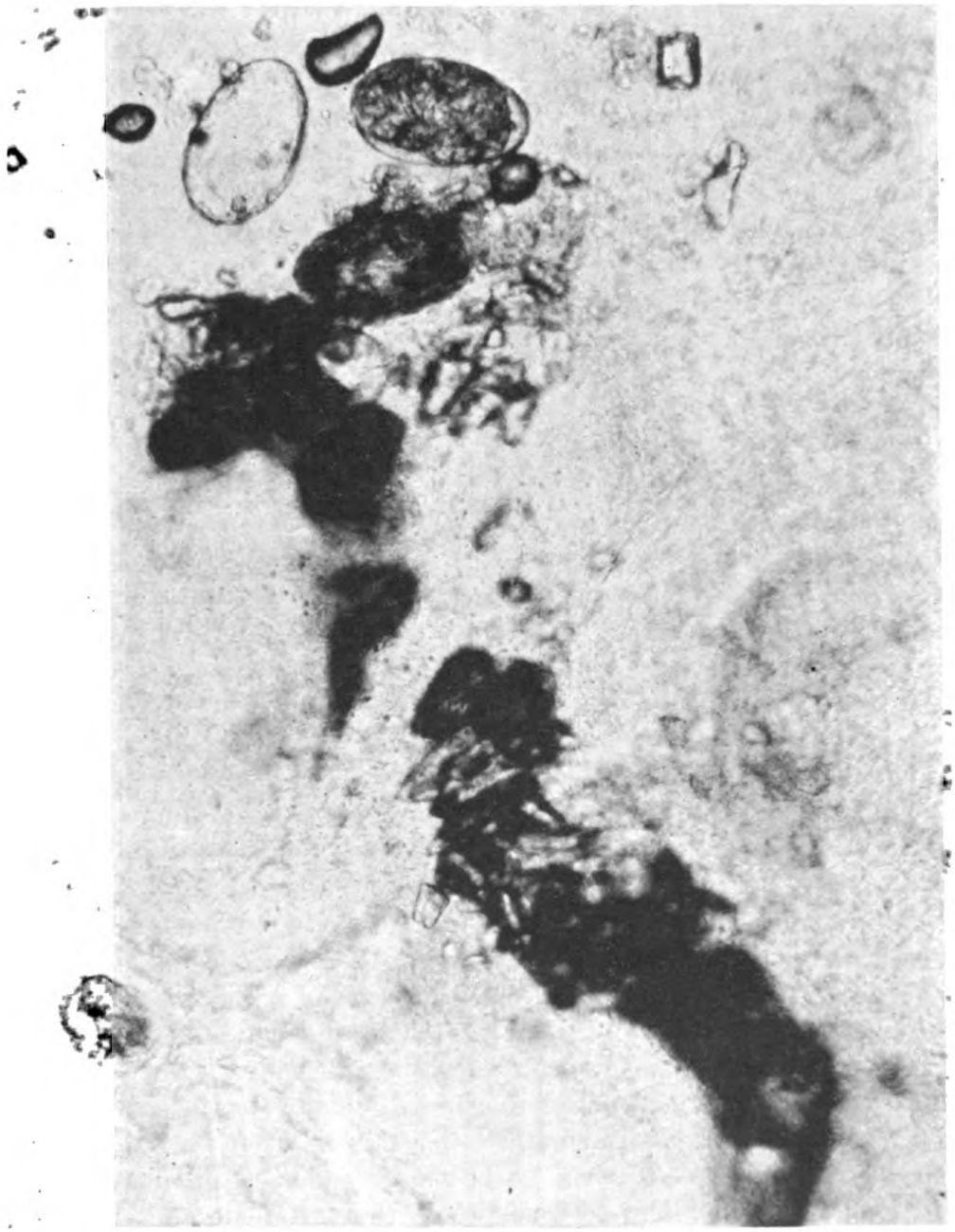
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—Official U. S. Navy Photo.

2. Acarus egg with embryo. **High power.**

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—Official U. S. Navy Photo.

3. Burrow showing eggs and acarus feces or scybala.

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A high percentage of cures from the use of sulfur was seen, but the appearance of untoward reactions from this treatment in as many as 25 percent of those so treated led to avoidance of its use if possible. For this reason sulfur ointment was not used but benzyl-benzoate was substituted as a therapeutic trial in atypical or suspected cases of scabies. Untoward reactions from use of 5 percent sulfur precipitate ointment were less common than with 10 percent and stronger ointments but the number of failures was higher.

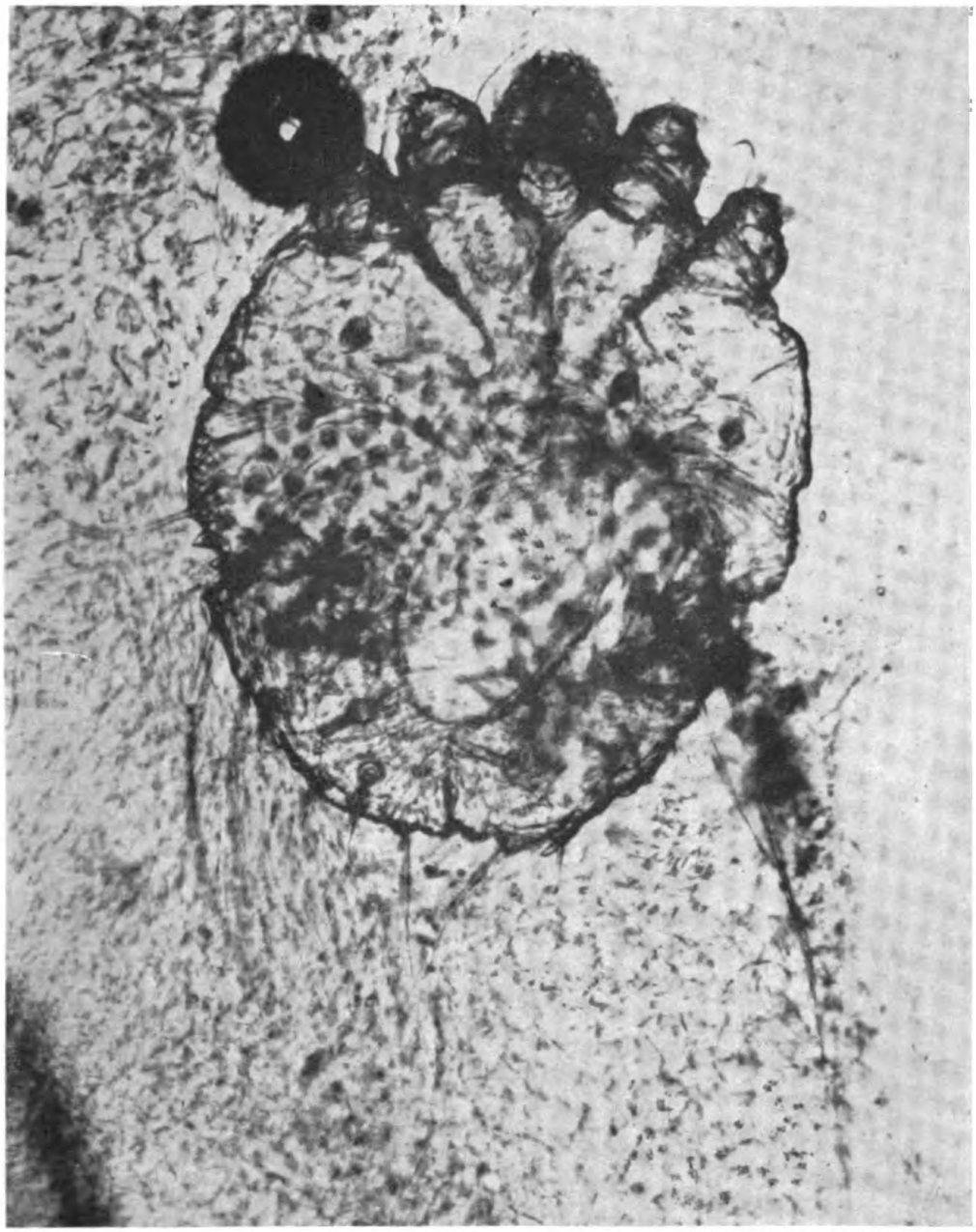
The reactions from sulfur ointment were as follows: A mild to severe dermatitis venenata appearing during the treatment or shortly after was the most common. This usually appeared first and was most severe about the neck, in the groin, and in the axilla. The appearance of eczematization, usually of a dry nummular type, as an aftermath of the dermatitis or occurring some days after apparent cure as a delayed response was less common but more intractable. The pyic type of lesions seen with many types of dematitis, and especially in that following the use of sulfur, such as furuncles, impetigo, pyoderma, folliculitis, and even sycosis of the beard were quite common and often very stubborn.

A positive patch test with sulfur was obtained in some of the dermatitis cases and in most of the eczema-like reactions, but a positive passive transfer was obtained in no case.

The appearance of polysensitivity in a number of cases of scabies with or without sulfur dermatitis and eczema was observed. A nummular eczema or dermatitis on return to duty after scabies was often seen in members of the Australian forces who became sensitive to the dye in their uniforms. In the Australian services the summer khaki was dyed with chromium and the winter woolen uniform was mordanted with chromium. Positive patch tests with potassium bichromate 1 percent and prompt clearing of the dermatitis when the uniforms were removed led to this diagnosis. The occurrence of uniform dermatitis in United States and other sailors from the mordant or dye in the Navy blue uniform has been observed after sulfur treatment of scabies. It has long been suspected that infantile and childhood eczema is prone to start after dermatitis or eczema from sulfur used for scabies and other skin diseases. The true role of the acarus and the byproducts as an eczematization factor is not well understood.

While making a scraping of the skin on an Australian Army private suspected of having khaki dermatitis or tinea of the groin, the accidental finding of an adult female acarus led to the routine search for this organism in all cases of typical and atypical scabies. This was particularly true in those for whom we were forced to use sulfur precipitate.

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—Official U. S. Navy Photo.

4. High power of adult female acarus showing egg in oviduct.

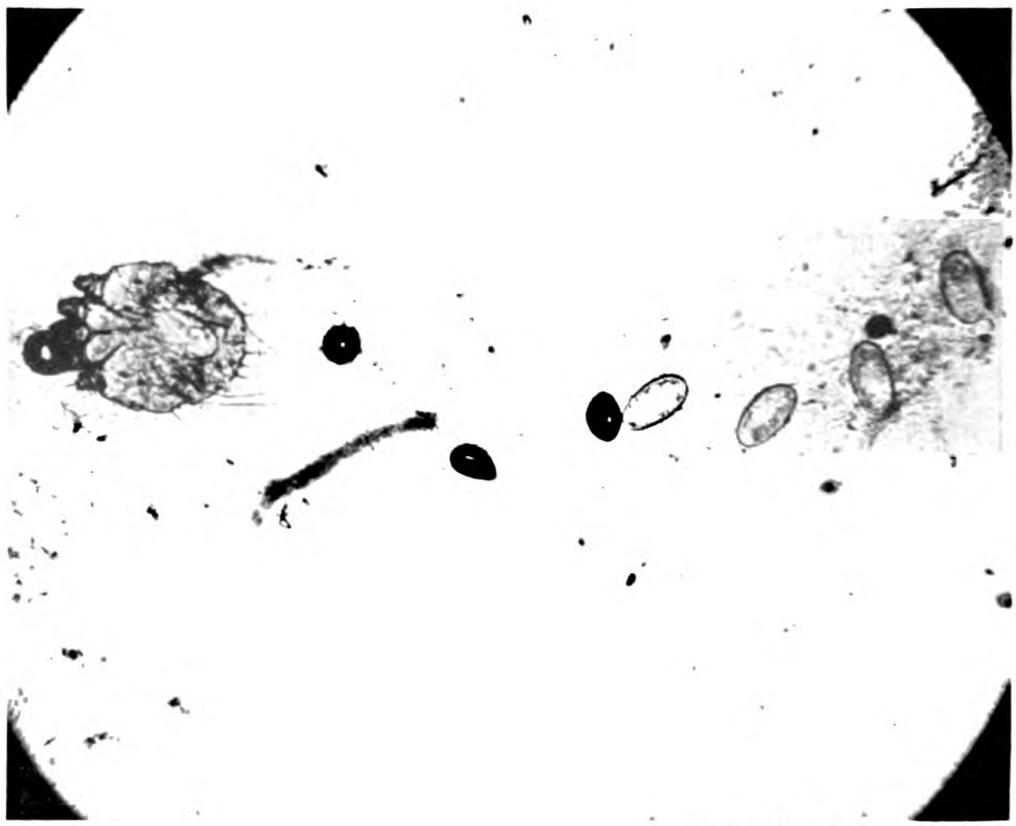
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The author at that time, for a few fleeting moments, believed he had discovered an original method of demonstrating the acarus, but the remembrance of the excellent photomicrographs exhibited at the last meeting of the Academy of Dermatology and Syphilology meeting just prior to the war soon dispelled this illusion. Friedman (*3*) noted that the acarus could easily be demonstrated by the scrape and smear method and also that the diagnosis could be made from finding the eggs, filled or empty, skeletal parts of the acarus, the larvae, and the scybala as well as from the adult acarus.

Mary Hopper (*4*) found this scrape and smear method also by accident and has used it for 6 to 8 years at the Cornell University Medical School. At the time of this observation she also was making a scraping for direct examination in a case suspected of fungous infection.

The purpose of this article is to help popularize this excellent method of making the diagnosis of scabies a more scientific matter. This method is not well known in this country and certainly not in Australia. Photomicrographs of the adult female, the hexapod larvae, the acarus eggs in various stages of hatching, empty acarus eggs, the acarus bur-



—Official U. S. Navy Photo.

5. Acarus burrow with adult female acarus and acarus eggs.

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—*Official U. S. Navy Photo.*

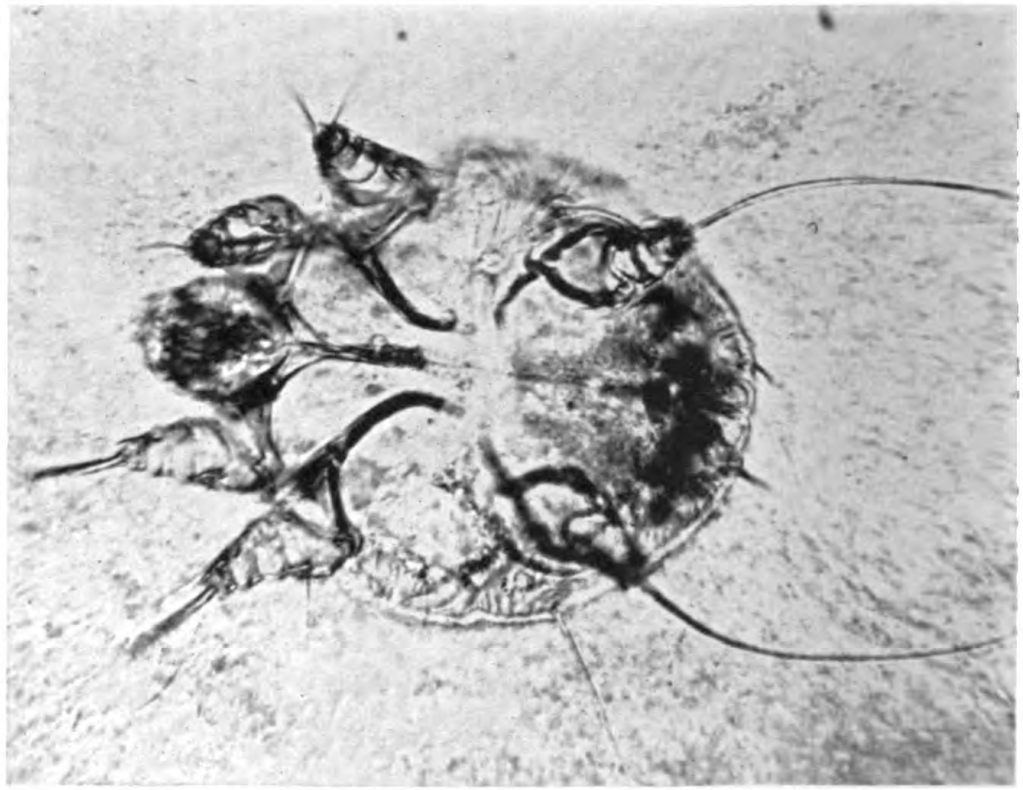
6. High power of acarus eggs.

row, skeletal parts of the acarus, and scybala also are shown to aid the reader and student in identifying them.

TECHNIC OF FINDING THE *SARCOPTES SCABIEI* ORGANISM AND ITS PARTS

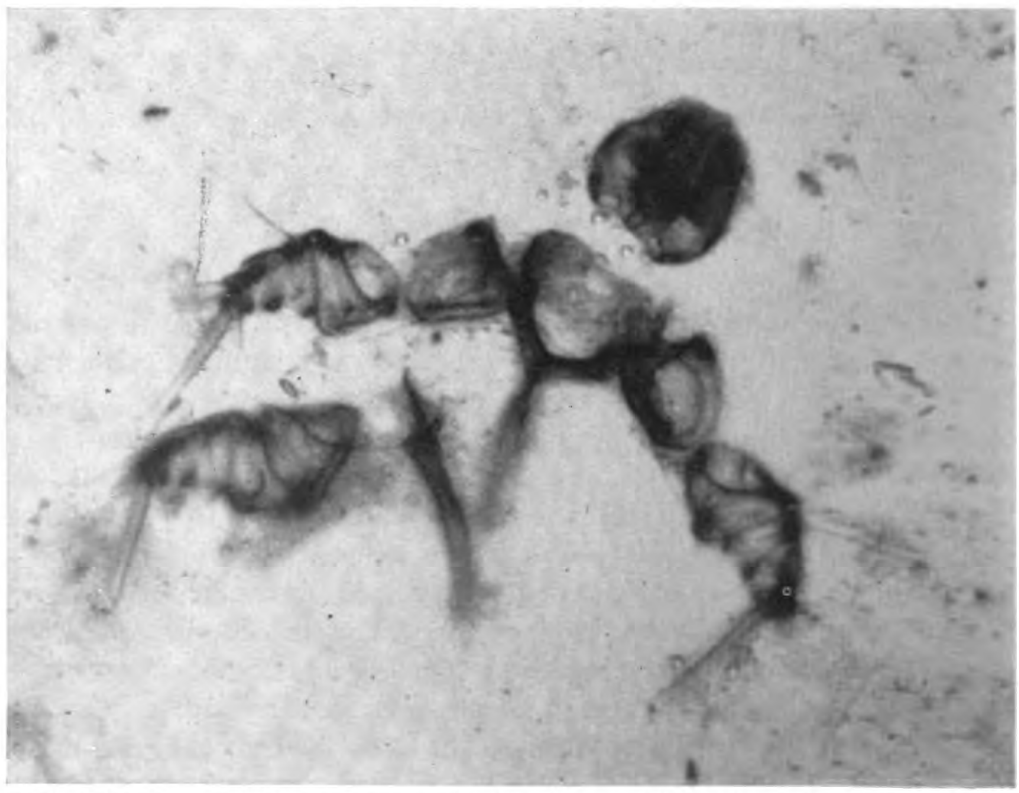
It is best to make a careful search over the parts affected to pick out lesions that will most likely give a positive diagnosis. Here experience helps a great deal. Ordinary rules of cleanliness and asepsis should be followed. For lesions on the fingers, on the interdigital webs, on the hands, wrists, and axillae a sterile, sharp razor blade is used to shave off a very thin slice of the vesicle, burrow or cuniculus, or excoriated papule. For lesions on the abdomen, genitalia, buttocks, and other parts less easily reached, scraping of the lesion with a sterile razor blade or Bard-Parker knife is best. The thin slice of epidermis, or the scrapings, is then placed on a glass slide, covered with a cover slip, and mounted in 10- or 20-percent potassium hydroxide solution, glycerin, water, or saline solution. The slide then is examined under low power, using the high power when needed.

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—Official U. S. Navy Photo.

7. Hexapod acarus larvae. High power.



8. Skeletal parts of the acarus. (All that is sometimes found in searching for the acarus by this method).

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Potassium hydroxide solution is used when one wishes to make a quick diagnosis as it rapidly breaks up the skin cells making it easy to see the acarus or any of its parts or products. If saline solution or water is used it is possible at times to find a scabies organism near the surface of the skin examined and then evidence of vitality can be seen.

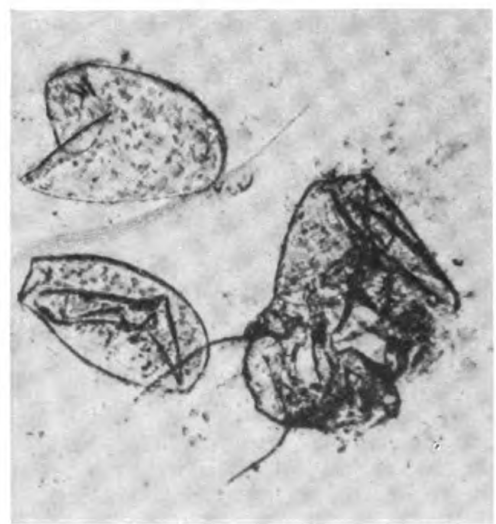
LIFE CYCLE OF *SARCOPTES SCABIEI* VAR. *HOMINIS*

The development of the acarus according to Brumpt (*5*) takes place in this fashion. The eggs hatch 7 days after being laid, releasing the hexapod larvae which soon leave the burrow to live on the healthy normal skin where they enlarge and undergo several moults. The first moult occurs about the sixteenth day giving rise to the octopod nymph which has 12 dorsal posterior spines. These live in crusts on the surface of the skin and moult again about the twenty-first day.

Another moult occurs about the twenty-eighth day setting free pubescent males and females which copulate. The fertilized females undergo further growth and development before becoming adults.

About the sixth week a final moult occurs and the female develops an oviduct for laying eggs. The female adult is pearly grey or pinkish and is 330 to 350 microns long and 250 to 350 microns wide. The female, fertilized, oviparous adult then burrows into the skin making its characteristic burrow, laying eggs as it goes. The eggs nearest the acarus in the burrow are the ones most recently laid. The eggs measure 150 by 100 microns in size.

The female ovum-bearing adult inhabits the end of the burrow. The males at times live in the burrow but usually are found outside the burrow under the epidermis. The male is pinkish and measures 200 to 235 microns long and 145 to 190 microns wide. The male organism has a penis and sucker in place of the last pair of posterior legs. The male acarus is a very elusive creature and is rarely seen.



—*Official U. S. Navy Photo.*

9. Empty acarus eggs and larva emerging from egg.

SUMMARY

The technic of the slice, scrape, and smear method for positive diagnosis of typical and atypical scabies is presented with photomicrographs of the acarus, acarus eggs (full and empty), hexapod

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larvae, skeletal parts of the acarus, scybala, and acarus burrows to make their recognition a facile matter. The life cycle of the *Sarcoptes scabiei* var. *hominis* organism is discussed.

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TREATMENT OF SEVERE ACUTE TONSILLITIS

The use of sulfonamides in the treatment of severe cases of acute tonsillitis results in a prompt drop in the temperature with some relief from symptoms. But there is usually a secondary rise in temperature at the time untreated cases are being discharged. The number of hospital days is increased from 5.3 to 9.7 and added to this is the clinical observation that the patients did not feel as well on the tenth day as thhe untreated cases did on the fifth. No conclusions are drawn concerning the use of an initial dosage only since in view of the other findings it seems highly suggestive that the use of sulfonamides in the treatment of acute "strep" tonsillitis is not only of no benefit but actually detrimental to the welfare of the patient.—CLODFELTER, H. M.: Treatment of severe acute tonsillitis with and without sulfonamides. Internat. M. Digest 48: 9–11, January 1946.

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AERODONTALGIA OCCURRING DURING OXYGEN INDOCTRINATION IN THE LOW-PRESSURE CHAMBER [1]

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Lieutenant, junior grade (DC) U. S. N. R.

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The problem of dental pain occurring as a result of changes in barometric pressure has been considered of sufficient importance in recent years to elicit a number of independent reports as to its incidence and cause. Although this incidence is uniformly low, variously reported by different authors at from 1 to 5.8 percent of individuals exposed to changes of pressure, it is often so severe in the individual case that it appears important from a military standpoint. The onset of aerodontalgia is often so sudden and severe that the attention of the individual experiencing the attack is distracted, often to the point of discontinuance of useful activity. As the pain continues until relief can be obtained by some means, commonly reascent or redescent in the case of aviators, this may constitute a considerable hazard when it occurs during military operations (see case history, Appendix).

The opportunity for studying aerodontalgia, as it occurred in the routine oxygen indoctrination of Marine Corps enlisted personnel in the low-pressure chamber, presented itself at this activity in the autumn of 1944. A syllabus of study was set up with the purpose of de-

[1] The authors acknowledge with appreciation the stimulating interest contributed to this study by Capt. Howard R. McCleery (DC) U. S. N., in the capacity of consultant and the invaluable assistance rendered by pharmacist's mates, second class, Barbara E. Dacey, Loyal G. Goff, and John Kamanar, U. S. N. R.; pharmacist's mates, third class, Martin D. Cohen and Mary B. Conlon, U. S. N. R.; and Frank H. Phelps, U. S. N., all low pressure chamber technicians, and pharmacist's mate, second class, Harry H. West, U. S. N. R., dental technician, general.

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termining the incidence and, if possible, the cause and treatment of dental pain occurring as a result of altered barometric pressure.

It was realized early in this study that some occurrence of "accidental" toothache would appear in individuals being indoctrinated in the low pressure chamber which had no association with the alteration of barometric pressure. However, it was decided that such apparent cases of coincidental dental pain would not be eliminated from the data as this might tend toward selectivity. Therefore, every case of dental pain occurring during our study sufficient to produce an observable response is recorded in this series.

TERMINOLOGY

The following descriptions and definitions of terms used in the text of this paper are supplied because of slight modifications in meaning from definitions which occur elsewhere:

Aerodontalgia.—Pain in isolated teeth or in teeth and their supporting structures occurring as an apparent result of altered barometric pressure.

The Valsalva Maneuver.—The classical Valsalva experiment, (not a modified Valsalva, such as is used for equalizing pressure in the middle ear). This consists of a forced expiration, the mouth being closed and the nose held by thumb and forefinger, creating a positive pressure in the oral and nasal pharynges and cavities.

Politzerization.—A modified Politzer method, consisting of forcing a continuous stream of air under measured pressure into the nasal cavity with the mouth and nostrils occluded. The subject is instructed not to swallow during the application of pressure.

SUMMARY OF THE LITERATURE

Previous studies of dental pain occurring at high altitude have placed the responsibility for this pain on a wide variety of dental conditions. Joseph et al. (*1*), on a basis of cases of aerodontalgia occurring during routine low pressure chamber runs at the U. S. Naval Air Station, San Diego, Calif., have stated that the presence of untreated or recurrent caries, degenerate pulps, and air spaces under dental fillings are the factors most commonly responsible for toothache in the aviator at high altitude. This paper especially points out that aviators experiencing dental pain are likely to attribute it to maxillary sinusitis. Brickman (*2*), working at the U. S. Naval Air Station, Pensacola, Fla., attributes most cases of aerodontalgia occurring in the low pressure chamber to the presence of recent fillings in the teeth involved. Pigott (*3*), working on civilian subjects in the low pressure chamber,

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in addition to other factors which he states may be responsible for dental pain, mentions the possibility of confusion of maxillary sinus pain with dental pain as a problem of differential diagnosis. Restarski and Gersh (*4*), U. S. Naval Medical Research Institute, Bethesda, Md., have advanced the theory that aerodontalgia may be due to something akin to aeroembolism of the dental pulp. Bunch and Beaton (*6*), U. S. Naval Air Station, Jacksonville, Fla., have stated that dental pain experienced at high altitude is a phenomenon resulting from changes in barometric pressure, i. e., sudden variations of altitude. They also state, "Where pain occurs in upper teeth a differential diagnosis from maxillary sinusitis must be made. Should the pain occur on descent, maxillary sinus involvement probably will be found to be the cause. Presence of a cold is closely interrelated here." A report from the Las Vegas Army Air Field Gunnery School, Las Vegas, Nev., (*7*) states the principal causes of aerodontalgia to be mechanically imperfect fillings, inadequately filled root canals, and pulpitis. It also states, "If toothache comes on during ascent or while at peak altitude, the only immediate treatment possible is descent; if it occurs during descent, reascent will alleviate symptoms." Mention is made that, in the absence of dental abnormalities, referred pain of aerosinusitis may be the cause of aerodontalgia.

Other conditions considered as being possible causes of dental pain are:

1. Use of improper filling materials.
2. Traumatic occlusion.
3. Presence of pulpal pathology.
4. Presence of pulp stones.
5. Presence of abscesses and cysts.
6. Inflammation of tissues surrounding the teeth.
7. Anoxia.
8. Contact of the teeth and surrounding structures with pure oxygen.
9. Low temperature.
10. Vibration, such as that produced by aircraft engines.

Many of these suggestions have been discredited by the work of Restarski et al. (*4*), (*5*), and Bunch et al. (*6*). Of the aforementioned proposed causes for aerodontalgia the following have been shown to be improbable by these authors:

1. Untreated caries.
2. Mechanically faulty fillings, including those with underlying air spaces.
3. Recent fillings.

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4. Contact of teeth and surrounding structures with pure oxygen.
5. Low temperature.
6. Vibration.

The literature on this subject was found to be remarkably deficient in data on such subjects as the number of cases involved, the location of teeth presenting dental pain, and the condition of reduced pressure existing at the onset of pain, i. e., altitude, and whether occurring during ascent or descent.

METHODS OF STUDY

The subjects used in this study were Marine Corps enlisted men regularly indoctrinated in the use of oxygen and oxygen equipment in the low pressure chamber at this activity.

All personnel indoctrinated in the use of oxygen euipment are familiarized with the use of such equipment and the routine of the run in a lecture previous to entering the chamber. At no time during the lecture or during the chamber run was the possibility of occurrence of toothache presented to the personnel being run.

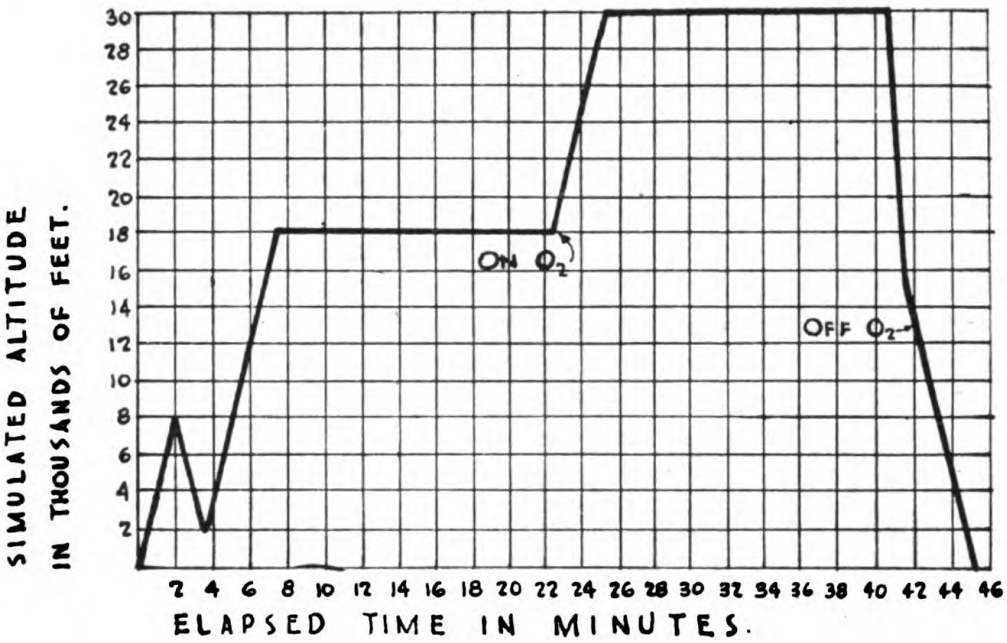
Previous to the run, the subjects were questioned pertaining to recent abdominal surgery or gastro-intestinal disorders, presence of upper respiratory infections, ingestion of drugs, such as excessive amounts of alcohol, aspirin, sulfa-derivatives, etc. Those who had a contraindicating history were eliminated from the run.

The routine indoctrination run begins with a simulated ascent to 8,000 feet, followed by a descent to 2,000 feet, for the purpose of eliminating persons unable to equalize the pressure in the middle ear with the ambient atmospheric pressure.

The pressure inside the chamber is then lowered at a rate simulating a climb of 4,000 feet per minute to an altitude of 18,000 feet above sea level (one-half an atmosphere). The subjects remain at this altitude without the use of oxygen for 15 minutes. At this time, the use of oxygen is begun and the chamber pressure is lowered at a rate of 4,000 feet per minute to a simulated altitude of 30,000 feet. The subjects remain at this level for a period of approximately 15 minutes, after which the chamber pressure is increased at a rate (15,000 feet per minute) simulating a "free fall" to an altitude of 15,000 feet. At this level, the rate of simulated descent is decreased to 4,000 feet per minute and maintained at this rate until arriving at sea level.

The routine indoctrination run in the low pressure chamber may be shown graphically as follows:

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1. Graphic representation of indoctrination run.

From time to time variations in the routine of this run are instituted as the occasion demands. If painful symptoms, i. e., in ears, sinuses, teeth, etc., occur at any time during the "ascent" or "descent," which are not immediately relieved, the chamber is "leveled off" at an altitude within a few thousand feet of onset, depending on the severity of the pain. If the pain is extremely severe, a reascent or redescent of 2,000 feet is made immediately, usually resulting in sufficient alleviation of the painful symptoms to allow the use of some method of treatment. If severe aerodontalgia occurs during the test run or if aerodontalgia becomes unbearable during ascent, the subject, after examination in the chamber, is removed without disrupting the indoctrination of the remaining subjects.

Subjects experiencing dental pain were examined in the chamber shortly after onset of the pain by exploration and percussion. At this time, the relief of the pain was attempted by the Valsalva Maneuver or by politzerization.[2] When relief occurred during continued ascent or descent, or during reascent or redescent as previously mentioned, before the Valsalva Maneuver or politzerization could be used, the method of relief was classified as "spontaneous." Upon completion of the run, the individuals experiencing pain were subjected to a complete oral examination, including x-ray series. A history was then taken of the patient concerning present or previous sinusitis, upper

[2] This apparently paradoxical procedure was instituted because of one previous case in which the Valsalva Maneuver had been successful in alleviating pain. This was attributed at the time to equalization of pressure in a dental cavity.

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respiratory infections, previous toothaches, previous dental work, previous chamber runs and/or actual high altitude flights, and any previous dental pain experienced during these runs or flights. A complete chart of cavities, fillings, and any other apparent dental pathology present at this time was made. When possible, these subjects were treated and recalled to the chamber for subsequent runs, or recalled for subsequent runs without treatment. Unfortunately, relatively few of the subjects were available for repeat chamber runs because of transfer of these individuals to duty at other activities. In a few cases, such severe pain was experienced during the first chamber run that the individuals were unwilling to volunteer for further runs. In view of the experimental nature of this work, repeat runs were made on a voluntary basis unless oxygen indoctrination had not been satisfactorily completed by the subject.

In addition to the regular subjects indoctrinated and observed, 14 individuals were selected who presented major dental pathology, such as large periapical abscesses, improperly filled root canals, pathological exposure of the pulp, acutely infected septic crypts about partially erupted teeth, residual root tip with fistulating sinus tract, fractured root, chronic suppurative pulpitis, radicular cyst, putrescent pulp, recent apicoectomy, and a large overhanging gingival margin of an amalgam filling which had produced extensive absorption of the interdental bone. These individuals were subjected to a special run in the low-pressure chamber involving the same time intervals and rates of ascent and descent as in the indoctrination run.

Sinus x-rays and examination by the ear, nose, and throat department were not made.

ANALYSIS OF DATA

This analysis is presented for the purpose of defining more clearly the factors which will be correlated and discussed in this paper. The data from which this analysis is assembled will be found in tables 1, 2, and 3 of the Appendix.

1. *Incidence of aerodentalgia.*—The total number of individuals indoctrinated in the low pressure chamber at this activity from the time of its commission, 26 September 1942, to the time of completion of this study, 1 May 1945, was 3,438. Sixty-three cases of aerodontalgia were recorded from these runs. This represents an incidence of 1.86 percent. The total number of individuals used in this study (1 October 1944 to 1 May 1945) is 920. Of this group, 37 individuals experienced aerodontalgia, representing an incidence of 4.02 percent. Of the 37 individuals experiencing toothache, 5 (13.5 percent) experienced pain during ascent and 32 (86.4 percent) during descent.

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No seasonal correlation was found with incidence of aerodontalgia. The incidence of aerodontalgia was evenly distributed throughout the age range (18 to 46) represented by the men indoctrinated.

2. *Recurrence of aerodontalgia.*—Of the 37 individuals who experienced aerodontalgia in the chamber, 7 (18.9 percent) were available for repeat runs. Five (71.4 percent) of the individuals rerun showed recurrence of analagous symptoms, while 2 did not show recurrence of aerodontalgia. One of these two, however, in whom aerodontalgia did not recur, had severe frontal sinus pain during his second run. Of the 5 individuals in whom recurrence of symptoms occurred, 2 had been treated for all existing dental pathology between runs. Of the 2 who did not show recurrence, 1 was treated between runs. (See table 1, Appendix. Cases 7–A and 8–A).

3. *Location of pain.*—Of the 37 individuals represented, 25 (67.5 percent) reported the pain to be localized in particular teeth. In 12 (32.4 percent), the pain was generalized in a particular region of the dentition. In 35 cases (94.5 percent), pain was located either in teeth approximating the maxillary sinus or in the region of the maxilla. Concomitant maxillary sinus pain occurred in some instances (see paragraph 8 of this analysis). In 2 cases (5.4 percent), the pain was localized in other teeth. (See table 1, Appendix. Cases 25 and 27).

4. *Subjective report on severity of pain experienced.*—Of the 42 cases of toothache experienced by the 37 individuals on original and repeat runs, 32 (76.2 percent) were described as severe or intolerable. Ten (23.8 percent) were described as a "dull ache." The onset of pain was described as sudden in 14 instances (33.3 percent). Thirty cases (71.4 percent) were persistent through a considerable range of pressure change, 11 (26.2 percent) were of very short duration and 1 consisted of intermittent short flashes of pain over an extremely long pressure change interval.

5. *Presence of dental abnormalities in the region where pain was experienced.*—Of the 42 cases of toothache experienced by the 37 individuals, 9 (21.4 percent) had cavities present in the region where pain was experienced. Thirty-five (83.3 percent) of the 42 cases of toothache presented fillings either in the teeth that ached or in the immediately adjacent teeth. In 5 (11.9 percent) cases, major dental pathology was demonstrated in close juxtaposition with the pain. Thirteen (30.9 percent) had teeth missing in the region where pain was experienced.

6. *History of sinusitis or present upper respiratory infection.*—Twenty-nine (78.3 percent) of the 37 individuals experiencing aerodontalgia gave a definite history of maxillary sinusitis or of a present upper respiratory infection, while 8 (21.6 percent) gave no history of either of these conditions.

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7. *Relief of pain.*—Of the 37 individuals experiencing aerodontalgia, 21 (57.1 percent) were relieved either during the chamber run or immediately following the chamber run by politzerization and 10 (26.1 percent) were relieved by the Valsalva Maneuver. The other 6 (16.6 percent) obtained spontaneous relief before either of the other two methods could be instituted.

8. *Association of aerodontalgia with concomitant maxillary sinus pain.*—Of the 42 cases of toothache experienced by the 37 individuals, 16 (38.1 percent) experienced maxillary sinus pain concomitantly with dental pain. Of this number, 14 (87.4 percent) gave history of chronic sinusitis or present cold. The remaining 26 (61.8 percent) cases of aerodontalgia experienced no sinus pain. Of these, 18 (69.2 percent) gave history of chronic sinusitis or present cold, while 8 gave no such history. Of these 8, all except 1 were dramatically relieved of their isolated tooth pain by either politzerization or the Valsalva Maneuver.

9. *Fourteen individuals selected for presence of major dental pathology.*—In 14 individuals chosen for presence of major dental pathology, the following conditions were found to be present:

	Cases
Periapical abscess	22
Pulp exposure	13
Improperly filled root canals	9
Impacted third molar teeth	8
Septic crypts about partially erupted teeth	4
Recent apicoectomy	2
Acute pulpitis	1
Chronic suppurative pulpitis	1
Putrescent pulp	1
Radicular cyst	1
Fractured root	1
Residual root tip with abscess	1
Overhanging amalgam filling with interdental bone destruction	1

In none of these cases was aerodontalgia or aerosinusitis experienced in original or repeat runs.[3]

DISCUSSION

From the foregoing assembly of rather disconnected data, several observations seemed to the authors to be of great significance.

Perhaps primary among these was that the pain, whether localized in particular teeth or generalized, in the far greater percentage of cases was located in the upper posterior quadrant of the mouth.

[3] The individual presenting the abscessed residual root tip mentioned was a low-pressure chamber technician making frequent runs in the low-pressure chamber. In the course of approximately 20 runs, during which this condition was known to be present, no symptoms of dental or sinus pain were experienced. The root was that of an upper first bicuspid, and was lying in contact with the mucous membrane of the maxillary sinus.

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Second was the frequency with which politzerization or the Valsalva Maneuver was successful in greatly or totally alleviating pain.

Third, and not particularly significant alone, was the high percentage reported of presence or history of maxillary sinusitis or present upper respiratory infection in an over-all group roughly screened to exclude the latter condition.

All three of these observations point to an origin of the pain in maxillary sinus block.

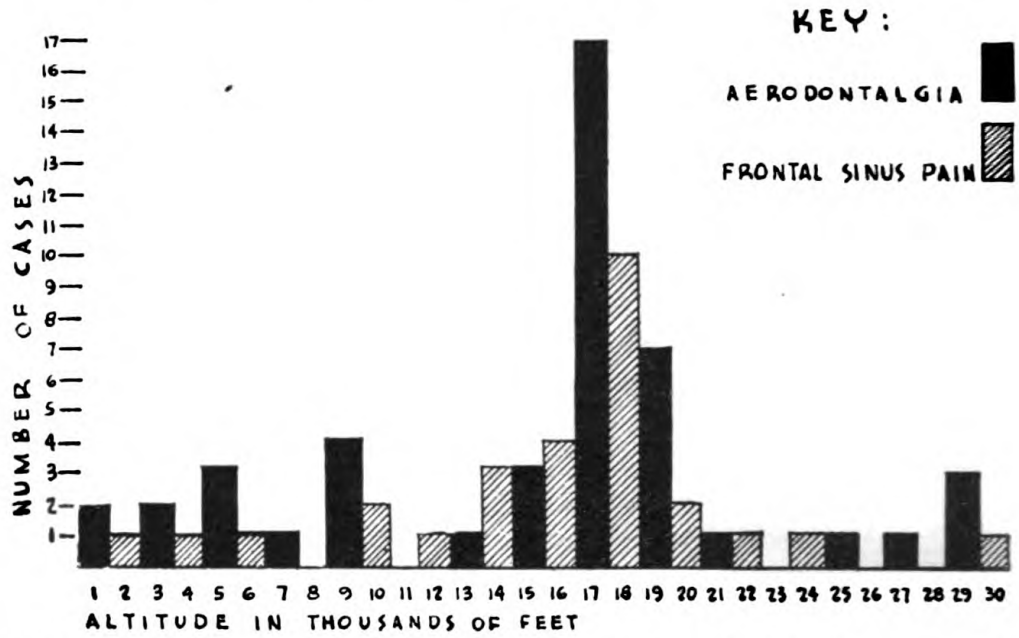
Several other contributing observations add to this conclusion. A fairly great number (38.1 percent) of the cases of aerodontalgia were associated with concomitant maxillary sinus pain. This group, in all probability, would have been classed as referred pain from the maxillary sinus in the majority of previous reports. The principal reasons for attributing toothache to maxillary sinus block in previous reports have been concomitant maxillary sinus pain and absence of dental abnormalities in the region where pain was experienced. If dental abnormalities, i. e., recent fillings, untreated caries, pulp stones, periapical abscesses, etc., were found in the region, these were classified as the etiological factors producing pain, without insight into a mechanism by which painful stimulation could be mediated from exposure of these conditions to altered barometric pressure. In the opinion of the authors, this has led to an unjustified confusion as to the cause of aerodontalgia. Bunch, et al., however, have partially eliminated this confusion by stating that in all probability all cases of aerodontalgia occurring on descent have their origin in maxillary sinus block. From a study of our series, no justification is seen for limiting this to occurrence of pain during descent, as sinus block, viz., in the case of the frontal sinus, occurs on ascent as well as on descent, albeit with lower incidence. The incidence of frontal sinus pain during the same period as our study of aerodontalgia occurred during ascent in 10.7 percent of cases, while dental pain occurred in 13.5 percent. This represents an extremely close similarity between the frequencies of occurrence of frontal sinus and dental pain on ascent. In fact, the occurrence of aerodontalgia is very closely related in many respects to that of frontal aerosinusitis; for example, the incidence of frontal sinus pain was 3.04 percent (28 cases in the same series of 920 men) as compared with an incidence of 4.02 percent (reported before) of aerodontalgia.[4] If the occurrence of these two types of pain with respect to altitude of onset is represented graphically (see fig. 2) an extremely close relationship is seen.

[4] The incidence of both these factors is considerably higher in our series than that recorded from other activities, the average incidence of both reported elsewhere being of the order of 1.0 percent. No explanation is attempted as to the cause of this high frequency of occurrence.

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Also it is interesting to note that there was no single record of isolated maxillary sinus pain [5] in our entire series of men indoctrinated since commission of this chamber.

Another fact, based only on subjective reports, which bears out our conclusion of origin of the pain in maxillary sinus block is that when individuals were relieved from pain by any of the three methods (politzerization, Valsalva Maneuver, or spontaneously) a "bubbling" or "breaking loose" sensation in the "nose" was frequently reported. Many of these cases were those in which pain was localized in particular teeth without concomitant maxillary sinus pain.



2. Relationship between incidence of aerodontalgia and frontal sinus pain with respect to altitude of onset.

On the basis of these observations, each individual was studied with respect to the amount of evidence in favor of the pain originating in maxillary sinus block. In arriving at the conclusion of origin of the pain in maxillary sinus block the following categories were used:

1. Relief obtained by means other than spontaneous (i. e., politzerization or the Valsalva Maneuver).

2. Concomitant occurrence of maxillary sinus pain with tooth pain.

3. Absence of dental abnormalities in the region where pain was experienced.

[5] That isolated maxillary aerosinusitis is uncommon as a recognizable symptom, is well demonstrated by the fact that no space is provided for the mention of this phenomenon in form NavMed–410 (8/44) on which are compiled monthly statistics of altitude training unit data, although such space is provided in the case of frontal aerosinusitis.

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4. Subjective report of the sensation of "breaking loose" indicative of clearing the sinus associated with relief.

5. History of maxillary sinusitis or present upper respiratory infection.

The results of the studies are presented next in tabular form, giving case numbers from table 1, Appendix.

Summary of evidence pointing to origin of aerodontalgia in maxillary sinus block with individual case numbers cited (see table 1, Appendix)

Supporting factors present	*Number of cases*	*Case Nos.*
Group 1: (*a*) Obtained total relief by either politzerization or the Valsalva Maneuver. (*b*) Maxillary sinus pain occurred concomitantly with tooth pain. (*c*) Presented a history of maxillary sinusitis or present upper respiratory infection.	12	3, 4, 6, 38, 39, 40, 41, 43, 47, 52, 57, 60
Group 2: (*a*) Obtained total relief by either politzerization or the Valsalva Maneuver. (*b*) Presented a history of maxillary sinusitis or present upper respiratory infection. (*c*) No dental abnormalities were present in the region where pain was experienced.	3	5, 36, 49
Group 3: (*a*) Maxillary sinus pain occurred concomitantly with tooth pain. (*b*) Presented history of maxillary sinusitis or present upper respiratory infection. (*c*) Reported a "bubbling" or "breaking loose" in the "nose" when total relief was obtained.	2	48, 51
Group 4: (*a*) Obtained total relief by either politzerization or the Valsalva Maneuver. (*b*) Presented history of maxillary sinusitis or present upper respiratory infection.	9	5, 7, 18, 25, 37, 44, 53, 59, 61
Group 5: (*a*) Obtained total relief by either politzerization or the Valsalva Maneuver. (*b*) Maxillary sinus pain occurred concomitantly with tooth pain.	2	2, 54
Group 6: (*a*) Obtained total relief by either politzerization or the Valsalva Maneuver. (*b*) No dental abnormalities were present in the region where pain was experienced.	1	42

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Summary of evidence pointing to origin of aerodontalgia in maxillary sinus block with individual case numbers cited (see table 1, Appendix)—Continued

Supporting factors present	Number of cases	Case Nos.
Group 7:		
(*a*) Presented a history of maxillary sinusitis or present upper respiratory infection. (*b*) Reported a "bubbling" or "breaking loose" in the "nose" when total relief was obtained.	2	45, 56
Group 8:		
(*a*) Obtained relief by either politzerization or the Valsalva Maneuver. (Cases No. 8 and 9 had tooth pain during ascent)	4	8, 9, 46, 50
Group 9:		
(*a*) Present no factors indicating maxillary sinus block (see following paragraph).	2	27, 58

It will be observed that in only two of the cases studied (Nos. 27 and 58) there is no evidence pointing to maxillary sinus block. The circumstances associated with the pain in these 2 cases were extremely similar. Both experienced the pain while the chamber was "leveled off" at 18,000 feet, the symptoms lasting for only a few seconds. No recurrence of pain appeared during ascent, descent, or while remaining at a higher altitude (30,000 feet). In both cases, recent, multiple, opposing, amalgam fillings were present. One of these individuals (case No. 27) reported the occurrence of a "metallic taste similar to that of a lead pencil" in the region of the tooth at the time when pain was felt. This individual also reported similar pain in this region both prior and subsequent to the low pressure chamber run. It is highly probable that both of these cases were due to static electricity generated between the recently placed amalgam fillings, which is not an uncommon phenomenon. It is believed by the authors that these cases bear no relationship to the lowered barometric pressure, but are instead instances of toothache occurring coincidentally with the low pressure chamber run (see page 845). We do not feel that this is to be interpreted as evidence indicating new fillings to be an etiological factor responsible for aerodontalgia; in fact, of 256 other known cases of recent fillings in our series, no symptoms of aerodontalgia were experienced. (Fillings were considered recent if less than 60 days old.) (See table 3, Appendix.)

These observations conclusively show that, at least in our series, the etiological factor acted upon by changes of pressure to produce aerodontalgia is an occluded maxillary sinus. However, the mechanism of pain mediation is still obscure. The most probable site of stimulation of sensory nerve endings by differential pressure between the antrum and the external atmosphere is the region of the ostium or ostia (*8*). This is borne out by the fact that when concomitant

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maxillary sinus pain was present it was concentrated in the region of the lateral nasal wall; and also that this is the region containing the greatest concentration of sensory nerve endings to the mucosa of the maxillary sinus. However, in the greater proportion of cases in our series, maxillary sinus pain, as such, did not occur concomitantly with the tooth pain. This leads to the conclusion that the stimulation from this point is subliminal in intensity.

It has been observed previously that the majority (90.4 percent) of cases of dental pain in our series occurred in teeth with abnormalities or in teeth immediately adjacent to those with abnormalities. This is in accordance with the findings of other investigators that abnormalities were usually found in teeth presenting symptoms of aerodontalgia,

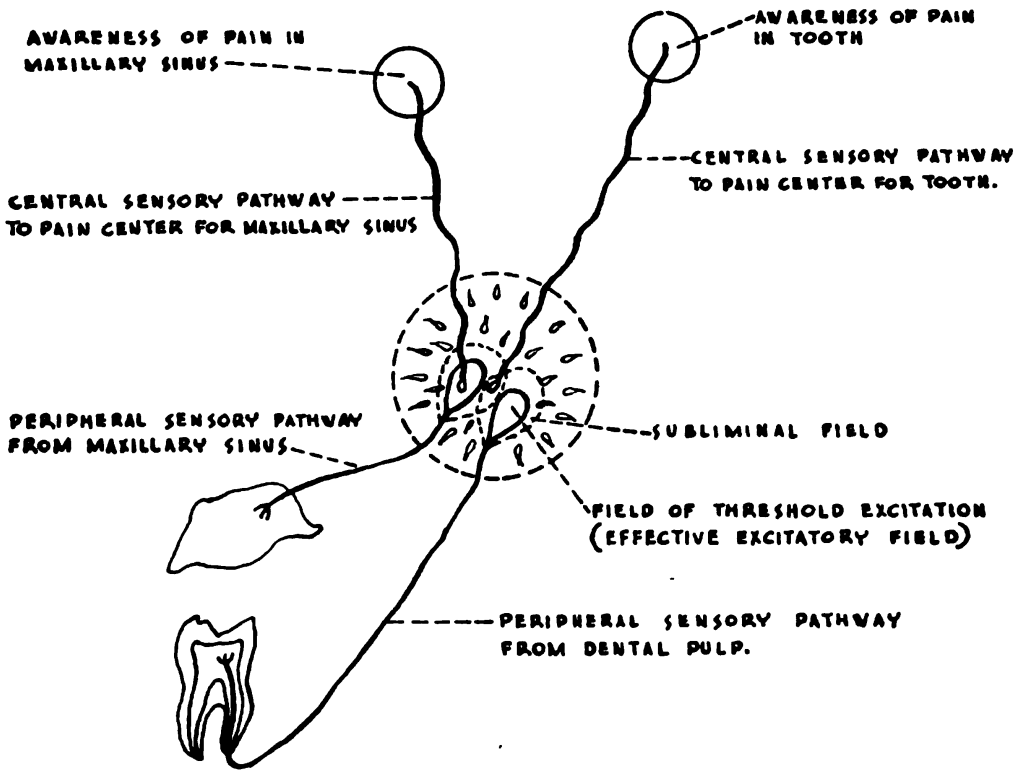


Figure 3.

These abnormal conditions, as has been mentioned previously, run the complete gamut of dental pathology. These phenomena together suggested to the authors the possibility of a mechanism similar to that of facilitation in motor reflexes. Such a mechanism might be termed a "reinforcement of sensory impulses." The mechanism for such a phenomenon might be explained as follows:

If a tooth which contains pathology insufficient to produce pain is postulated, this tooth might be considered as giving rise to a series of subliminal or inadequate

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stimuli over its sensory nerve. These inadequate stimuli, on arriving at some central point of transmission, do not give rise to sufficient excitation to produce a stimulus to the central pathway and thereby subjective awareness of pain. However, if impulses are also traversing a closely associated peripheral pathway, (i.e., from the maxillary sinus) it is conceivable that these may reinforce the original impulse to such an extent that the central pathway is stimulated and subjective awareness of pain is produced. This concept may be schematically represented by a diagram such as figure 3.

Figure 3 represents the condition in which maxillary sinus pain and dental pain occur concomitantly. As is shown in the diagram the field of threshold excitation from the peripheral sensory pathway (P S P) of the maxillary sinus includes the receptor for the central sensory pathway (C S P) from the maxillary sinus. Thus, stimulation of the C S P to the pain center for the maxillary sinus occurs and awareness of pain in the maxillary sinus results. However, the field of threshold excitation resulting from stimulation of the P S P from the tooth does not include the receptor for its C S P, so no stimulation of the C S P would occur, and resulting pain would not be produced without intervention of reinforcement. This reinforcement might occur as follows: The subliminal fields (i. e., areas in which excitation is present at a level inadequate to produce stimulation) from the two peripheral sensory pathways overlap, including the receptor for the C S P to the tooth's pain center. This results in stimulation of the C S P and subjective awareness of pain in the tooth.

Many modifications of such a mechanism are possible. Figure 4 represents the condition of dental pain in a tooth with an abnormality without concomitant maxillary sinus pain. This is shown in the diagram by the fact that the receptor for the C S P to the pain center for the maxillary sinus is not included in the effective excitatory field of the P S P from the maxillary sinus; however, the receptor from the C S P for the tooth is included in the overlap of subliminal fringes of the two peripheral pathways.

Figure 5 represents a mechanism by which pain might be produced in a tooth without abnormality, providing an abnormality producing subthreshold stimulation is present in another, ipsolateral, tooth.

No example can be found in the literature which corresponds exactly with this hypothesis, i. e. reinforcement of sensory impulses, since all examples encountered involve a motor response. However, such reinforcement is well established in motor reflexes and, insofar as the authors can see, no fundamental difference exists between purely sensory transmission of pain and the nervous transmission of motor reflexes, except that of facility of observation and measurement in the latter.

If this theory is correct, it may be used to explain a multitude of apparently conflicting reports. Since any abnormalities present in

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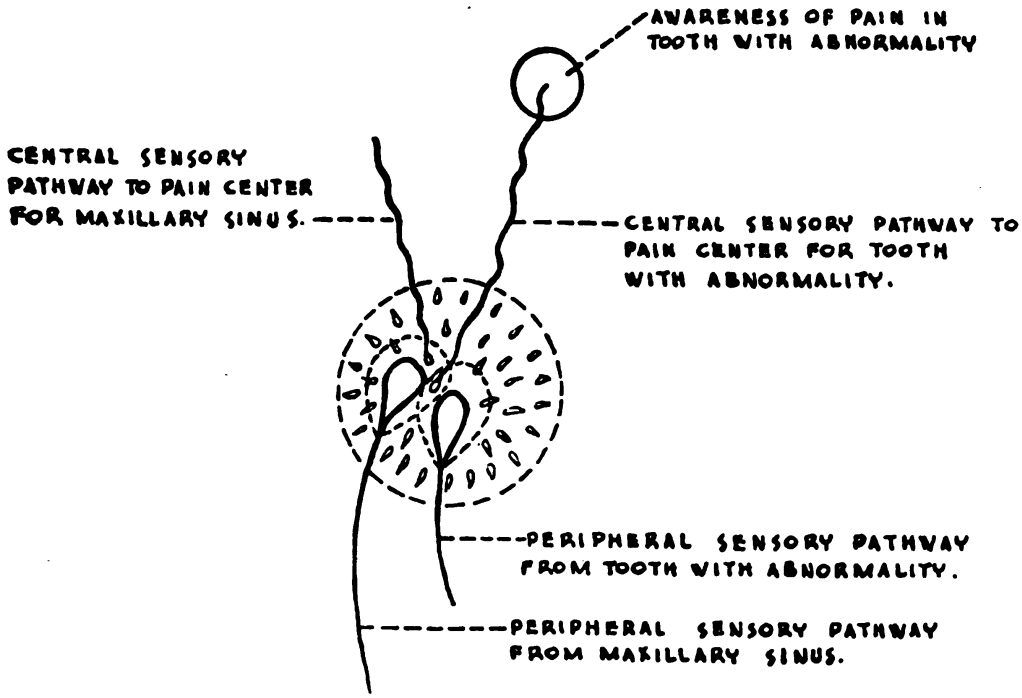


Figure 4.

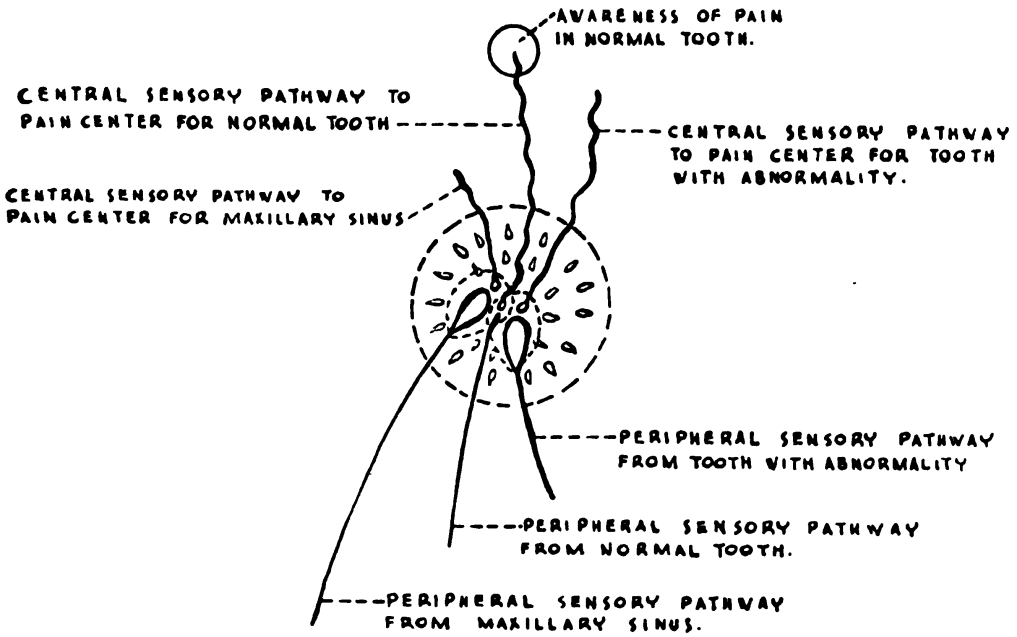


Figure 5.

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the dentition capable of producing subliminal stimuli may be responsible for localization of pain in the region of the abnormality, provided the principal stimulus of maxillary sinus block is present, the wide variety of conditions reported by previous investigators to be present in teeth presenting symptoms of aerodontalgia is explained. On the other hand, innumerable cases of varied dental pathology might be subjected, experimentally or otherwise, to altered barometric pressure, and in the absence of maxillary sinus block would give rise to no subjective symptoms of aerodontalgia. It should be mentioned, however, that dental pathology, particularly in teeth approximating the maxillary sinus, may be conducive to some degree of maxillary sinusitis, thereby rendering the antrum more susceptible to occlusion during alteration of barometric pressure. It is also possible that by repeated exposures to reduced pressure, sufficient drainage of the sinus could be effected to reduce the probability of occurrence of maxillary sinus block. This may explain the lack of symptomatology on repeat runs after dental treatment for which this dental treatment has been held responsible.

This theory also explains the often-reported phenomenon of recurrence of aerodontalgia in a tooth which has been extracted between exposures. (See case 3, table 1, Appendix.) This phenomenon apparently bears a close relationship to that of "phantom limb" pain, in comparison with which the maxillary sinus may be considered as the "trigger point" and the stump of the amputated nerve from the tooth that which is in a condition of "hyperesthesia" (*9*).

Owing to the fact that previous reports have omitted presentation of large portions of their data, it is difficult for us to determine whether we have encountered the same pattern of occurrence of aerodontalgia as that in these previous reports. However, it is felt from our relatively high incidence of dental pain that causes of aerodontalgia other than maxillary sinus block, if they do occur, are greatly in the minority. Our data tend neither to substantiate nor disallow the theory of aeroembolism of the dental pulp as a cause of aerodontalgia, if it occurs during longer stays at altitude or at higher altitudes than those represented in our study (15 minutes at 30,000 feet).

SUMMARY

1. The incidence of aerodontalgia occurring during the course of this study was 4.02 percent.

2. The greater proportion (86.4 percent) of these cases of aerodontalgia occurred during descent.

3. In individuals with previous aerodontalgia given repeat runs, the occurrence of dental pain was 71.4 percent.

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4. The pain of aerodontalgia was located in upper posterior teeth in 94.5 percent of cases studied.

5. Dental abnormalities were found to be present in the region where pain was localized in 90.4 percent of cases studied.

6. History of maxillary sinusitis or present upper respiratory infections were encountered in 78.3 percent of individuals reporting aerodontalgia.

7. Maxillary sinus pain occurred concomitantly with aerodontalgia in 38.1 percent of cases.

8. Pressure equalization methods, such as the Valsalva Maneuver and politzerization were found to be extremely effective in relief of toothache.

9. From these findings, the predominant cause of dental pain occurring in our series was interpreted to be sinus block with referred pain to the teeth.

10. A nervous mechanism is suggested which might account for all of the variant phenomena observed in the present and previous investigations.

11. Recommendations are made regarding methods of obtaining relief from aerodontalgia and its prophylaxis.

CONCLUSIONS AND RECOMMENDATIONS

1. It is concluded from our observations of the severity of aerodontalgia that pain is so severe in a large percentage of cases that sufficient distraction of the individual experiencing the pain is produced to render him incapable of performing important tasks with proficiency. Therefore, it is believed that aerodontalgia, although of low incidence, is of importance as a negative factor in the successful operations of military aviation.

2. The majority of cases of dental pain occurring in the low pressure chamber at this activity are a result of referred pain from the maxillary sinus.

3. Pressure equalization technics similar to those used for relief of aero-otitis media (politzerization and the Valsalva Maneuver) are highly effective in relieving this sinus block and thereby the referred tooth pain.

4. It is recommended that the Valsalva Maneuver be practiced by individuals experiencing aerodontalgia in aircraft and low pressure chambers, and that politzerization be used at sea level if the former means has not proven effective.

5. In individuals susceptible to aerodontalgia the use of a vasoconstrictor, such as a benzedrine inhaler (which is known to be very effective in preventing frontal sinus block) during ascent may be effective in reducing the occurrence of this disorder.

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6. In view of the tendency for pain referred from the maxillary sinus to localize in teeth with abnormalities, and the possibility of maxially sinusitis resulting from pathology in the upper posterior teeth, it is considered essential that good oral hygiene and attention to regular dental examination by the dental officer be practiced by all aviation personnel.

7. It is strongly recommended that further research in this field and better dissemination of pertinent data be put into effect.

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APPENDIX

TABLE 1.—*Compiled data on cases of aerodontalgia and cases presenting major dental pathology without aerodontalgia*

Case No	1	2	2A	3	3A	4	5	6
Pain	No.	Yes	Yes	Yes	Yes	Yes	Yes	Yes.
Location of pain		#2 Rt. max. sinus. Rt. frontal sinus.	#2	Rt. max. sinus and upper rt. quad.	Left ear and #2	Upper right post. quad. Slight soreness over rt. max. sinus.	#14	Left max. sinus and upper left molar teeth.
Type of pain as described by patient.		Severe. Sudden onset finally localized in #2.	Sudden. Severe. Persistent.	Severe. Generalized. Aching.	Severe ache in #2	Generalized. Severe. Sudden onset.	4 sharp pains	Severe. Sharp. Sudden onset.
Altitude, ascent, or descent.		D 18,000′ F F. Pain persisted to sea level.	D 8,000′. A to 10,000′ slight relief obtained. D @ 5,000′ per min.	D 15,000′	D 15,000′	D 2,000′	A 18,000′	D 10,000′.
How relief was obtained.		Polit. post. run	Valsalva maneuver.	Polit. in chamber	Polit. in chamber	Polit. post run	Valsalva maneuver.	Valsalva maneuver.
History by patient.	Gum boil over #9. APO and RCF #10. 1 month previous.	Denies previous sinus trouble. No cold. No previous toothache in this region.		Recovering from cold @ present. Sinus trouble 5 yrs. ago. No trouble since.		Sinus trouble all his life. No cold @ present.	Slight cold. Denies sinus trouble. Pulp exp. #14 2 weeks prev.	Sinus trouble past 9 yrs. No cold @ present. Trauma and event. removal of #12, #13, and #14 15 yrs. ago.
Non-path. fillings		#2 small O-am		#2 MO-am. #3 DO-am.		#2 O. #3 O. #4 MOD. #5 DO.	#12 MOD. #13 MOD. #15 O.	#15 O-am. #16 O-am.
Pathological findings including x-ray.	#9 PA asbcess. #10 properly filled RC & regenerating bone at site of APO. Soft tissue healed.	#3 removed 14 yrs. previous. Rt. max. sinus cloudy. #9 poorly filled RC & large PA abscess.		#3 MO. #2 pulp exp. PA abcess #18 E.	None	Incomplete RCF #4. #3 MO. cav.	#14 MO-am. & pulp exp.	#12. #13, #14 missing.
Previous trouble	None	None		None	As described	None	None	None.

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Previous runs and actual flights.	No PCR. Numerous act. fl. to 20,000'.	No PCR. No act. fl.	----------	1 PCR. No act. fl.	2 PCR. No act. fl.	No PCR. Actual fl. to 15,000' 1 yr. ago (no sinus trouble at that time).	No PCR. No act. fl.	1 PCR. Noact. fl.
Treatment since first run.	----------	----------	None	----------	#3 MO-am #18 E-am. #2 ext.			
Case No.	6A	7	7A	8	8A	9	9A	10
Pain	Yes	Yes	Yes	Yes	No	Yes	Yes	No.
Location of pain	Upper left molar region.	#14. Both frontal sinuses.	Left frontal sinus. No tooth pain.	#14		#16 became generalized in upper left post. quad.	Generalized upper left post. quad.	
Type of pain as described by patient.	Same	Severe. Persistent.	Extremely severe.	Intermittent dull ache.		Increased in severity @ higher altitude until it was unbearable.	Barely percept. @ 8,000' OK. @ 5,000' to sea level. Up again 8,000' to 12,000'. Pain more severe @ 12,000'.	
Altitude, ascent, or descent.	D 10,000'	D 30,000'	D 21,000'	A 10,000'		A 5,000' ceased @ 2,000', began again @ 5,000' increased to 13,000.'	A 8,000'	
How relief was obtained.	Polit. in chamber.	Polit. @ 10,000'	Ret. to 25,000' Valsalva.	Polit. post run		Valsalva maneuver @ 10,000'.	Polit. in chamber.	
History by patient.	----------	Sinus drainage for 10 yrs. #13 ext. 18 months prev. c exp. of max. sinus.	No sinus trouble since last run.	#14 filled 7 mo. previous. Has sharp pain every 2 to 3 wks. since. No sinus trouble. No cold @ pres.	----------	#16 filled 3 months prev. Denies sinus trouble. No cold.	----------	No sinus trouble. No cold.
Non-path. fillings	----------	#14 MOD-am. #16 MO-am.	----------	----------	----------	#12 DO, #13 DO, #14 O, #16 O.	----------	

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TABLE 1.—*Compiled data on cases of aerodontalgia and cases presenting major dental pathology without aerodontalgia*—Continued

Case No.	6A	7	7A	8	8A	9	9A	10
Pathological findings including x-ray.		#13, #15 missing		Traumatic occlusion #14. #16 unerupted.	# 16 unerupted	# 14 MO. cav	None	#8 lg. cem. sil. Pulp exp. PA abscess.
Previous trouble		None	As described	None		None	As described	None.
Previous runs and actual flights.	2 PCR. No act. fl.	No PCR. No act. fl.	1 PCR	No PCR. No act. fl.	1 PCR	2 PCR. No act. fl.		No PCR. No act. fl.
Treatment since first run.	None		None		Traumatic occ. corrected on overfilled #14 MO-am.		#14 MO-am	

Case No.	11	12	13	14	15	16	17	18
Pain	No	No	No	No	No	No	No	Yes.
Location of pain								Radiated from left ear through left temporal region. Localized in upper left posterior teeth.
Type of pain as described by patient.								Severe ache.
Altitude, ascent, or descent.								D 6,000′.
How relief was or obtained.								Valsalva post run.
History by patient.	No sinus trouble. No cold.	Chronic sinusitis for past 10 years.	No sinus trouble. No cold.	No sinus trouble. No cold.	No sinus trouble. No cold.	No sinusitis. No cold.	No sinus trouble. No cold.	Sinus trouble for 2 years. Cold @ present.

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Non-path. fillings								#12 DO, #13 D.
Pathological findings including x-ray.	#10 2 lg. cem. sil. Pulp exp. Lg PA abscess.	X-ray neg	Lg. gold shell Upper rt. max sinus cloudy. Lg. PA abscess #3.	#8 lg. cem. sil. filling. Pulp exp. PA abscess. Bone destruction extending about apical half of root.	#29 lg. MOD-am ☁ improperly filled RC. PA abscess.	#7, #8, #9, #10 Pulp exp. Lg. PA abscesses.	#10 improperly filled RC. PA abscess.	#14 missing. #15 decay under O-am. #16 normally erupted.
Previous trouble	None	None	None	None	None	None	None	None.
Previous runs and actual flights.	No PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.	No PCR. Act. fl. to 10,000'. Dove to 2,000' & no trouble.
Treatment since first run.								
Case No	19	20	20A	21	22	23	24	25
Pain	No	No	No	No	No	No	No	Yes.
Location of pain								Generalized upper and lower rt. side finally localizing in #18.
Type of pain as described by patient.								Severe. Localized pain was dull ache.
Altitude, ascent, or descent.								D 3,000'.
How relief was obtained.								Polit. post rum.
History by patient.	No sinus trouble. No cold.	No sinus trouble. No cold.	No sinus trouble. No cold.	No sinus trouble. No cold.	No sinus trouble. No cold.	No sinus trouble. No cold.	No sinus trouble. No cold.	No sinus trouble. Has sl. cold. #18 filled over 8 yrs. ago. No previous toothache.
Non-path. fillings								#18 sm. MO-am.

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TABLE 1.—*Compiled data on cases of aerodontalgia and cases presenting major dental pathology without aerodontalgia*—Continued

Case No	19	20	20A	21	22	23	24	25
Pathological findings including x-ray.	#9 overfilled RC. PA abscess Fractured root.	#24 acute pulpitis and eventual chronic suppurative pulpitis.	#24 incompletely filled RC. Apical thickening of periodontal membrane.	#23 devital c̄ radicular cyst approx. 5 mm in diam. #4 PA abscess. Pathological pulp exp.	#4 Pathological pulp exposure c̄ periapical rarefaction.	Full line crown around #5. Devital pulp Partially filled RC. Apical rarefaction #2. Pathological pulp exp.	#7 lg. cem. sil. filling. Pulp exp. Lg. PA abscess.	19 missing.
Previous trouble	None	None	As described	None	None	None	None	None.
Previous runs and actual flights.	No PCR. No act. fl.	No PCR. No act. fl.	1 PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.	No PCR. No actual fl.	No PCR. No act fl.
Treatment since first run.								

Case No	25A	26	27	28	28A	29	30	31
Pain	Yes	No	Yes	No	No	No	No	No.
Location of pain	Upper and lower rt. side.		#20, #21					
Type of pain as described by patient.	Slight dull ache localized in upper rt. post. quad. "Not ache but funny sensation."		Felt like electric shock. Metallic taste like touching a pencil to fillings.					
Altitude, ascent, or descent.	D 2,000′		A 18,000′					
How relief was obtained.	Spontaneous post run.		Spontaneous					
History by patient.		No sinus trouble. No cold.	#4, #5, #20, #21 filled 1 week previous. Similar pain while eating since teeth were filled.	Path. in #9 due to trauma 5 yrs. ago.		No sinus trouble. No cold.	No sinus trouble. No cold.	#9 RCF 10 years ago. No sinus trouble. No cold.

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Non-path. fillings			#4 MO, #5 DO, #20 MO, #21 DO.					
Pathological findings including x-ray.		Putrescent pulp & PA abscess #13. Improperly filled RC & PA abscess #12.	None	#9 PA rarefaction discolored as a result of internal hem. #1, #16, #17, #32 horizontally impacted.	#9 RCF; evidence of apioectomy. Regenerating bone. Incision healed.	#17, #32 horizontally impacted & large septic crypt.	#17 mesioangular impaction & large septic crypt.	#9 improperly filled RC & PA abscess. Cellulitis of upper lip one week after run.
Previous trouble	As described	None	Same type of pain in same teeth twice previously.	None	None	None	None	None.
Previous runs and actual flights.	1 PCR. No act. fl.	No PCR. No act. fl.	No PCR. Act. fl. to 20,000′ no trouble.	No PCR. No act. fl.	1 PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.
Treatment since first run.					RCF & apioectomy 7 wks. previous 1 wk. following first run.			

Case No.	31A	32	33	34	34A	36	37	38
Pain	No.	No.	No.	No.	No.	Yes	Yes	Yes.
Location of pain						#3	#13	Upper rt. post. teeth. Rt. max. sinus.
Type of pain as described by patient.						Severe. Gradual onset.	Severe. Gradual onset.	Sudden onset. Severe ache.
Altitude, ascent, or descent.						D 18,000′	D 17,000′	D 15,000.′
How relief was obtained.						Polit. @ 12,000′	Polit. in chamber	Polit. post. run.

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TABLE 1.—*Compiled data on cases of aerodontalgia and cases presenting major dental pathology without aerodontalgia*—Continued

Case No.	31A	32	33	34	34A	36	37	38
History by patient	Same	No sinus trouble. No cold.	No sinus trouble. No cold.	No sinus trouble. No cold.	No sinus trouble. No cold.	Sinus trouble 3 yrs. ago. No cold.	No sinus trouble. Has slight cold.	Sinus trouble all his life. #3 ext 12 years ago.
Non-path. fillings							#12 MO	None.
Pathological findings including x-ray.	#9 properly filled RC c̄ apioectomy. Regenerating bone. Incision healed.	#32 mesioangular impaction, acute infection of septic crypt. #30 lg. overhanging DO c̄ interproximal bone destruction.	#7 pathological pulp exp. c̄ lg. PA abscess. #10 incompletely filled RC c̄ apical rarefaction.	#12 missing residual root tip approximating max. sinus. Abscess c̄ fistulous tract extending downward. No apparent sinus involvements.	#12 missing regenerating bone at site of operation. Incision healed.	All teeth present, completely erupted. No cavities.	X-ray neg. No cavities.	#3 missing. X-ray neg.
Previous trouble	None	None	None	None	None	None	None	None.
Previous runs and actual flights.	1 PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.	Numerous PCR. No act. fl.	Numerous PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.
Treatment since first run.	#9 RCF and apioectomy.				Removal of residual root, c̄ curettage of infected area.			

Case No.	39	40	41	42	43	44	45	46
Pain	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes.
Location of pain	#15 left max. sinus.	#2 sl. soreness of rt. max. sinus.	#1-2-3 & sl. soreness over rt. max. sinus. No localization of pain.	#13	Upper left post. teeth and gums. Tenderness over left max. sinus.	#2-3	Upper rt. post. teeth.	#4.
Type of pain as described by patient.	Sl. soreness over sinus. Severe tooth ache.	Sudden onset severe pain. Persistent.	Generalized dull ache increasing on descent.	Sharp sudden severe pain.	Lancinating knife-like pain. Sudden onset.	Lancinating knife-like pain. Sudden onset.	Felt like something broke in nose @ 15,000'.	Sharp sudden onset.
Altitude, ascent, or descent.	D 28,000'	D 5,000'	D 18,000'	D 2,500'	D 18,000'	D 18,000'	D 19,000'	D 19,000'.

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How relief was obtained.	Valsalva @ 15,000'.	Polit. post. run tooth & sinus relieved.	Valsalva @ 5,000'.	Valsalva post run.	Polit. in chamber.	Valsalva.	Spontaneous @ 15,000'.	Polit. @ 15,000'.
History by patient.	Sinus dr. past 6 years. No cold. Chronic catarrh.	Sinus trouble all his life. Slight cold.	Sinus trouble for 2 years. Has cold.	No sinus trouble. No cold.	Sl. cold. No sinus trouble. #12-13-14-15-16 ext. over 2 yrs. ago.	No sinus trouble. No cold. Chronic cough.	Sinus trouble 2 yrs. ago. No trouble since. No cold.	No sinus trouble. No cold.
Non-path. fillings.	#15 O-am; #14 MO-am.	#3 O-am; #4 MO-am.	#1 O-am	None	None	#2 O-am; #3 O-am.	#3 MO; #5 DO	#2 MO-am.
Pathological findings including x-ray.	Negative	X-ray neg	X-ray neg	All teeth present. Good occlusion. X-ray neg.	#12-13-14-15-16 missing. X-ray neg.	#5 O-cavity. X-ray neg.	X-ray neg	#4 pit cav. X-ray neg.
Previous trouble.	None	None	None	None	None	None	None	None.
Previous runs and actual flights.	No PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.
Treatment since first run.								

Case No.	47	48	49	50	51	52	53	54
Pain	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes.
Location of pain	Rt. max. sinus. Upper rt. post. teeth. Pain did not localize.	Upper rt. post quad. Rt. max. sinus.	#2, #3	#13	#14; upper left max. sinus.	#15; upper left max. sinus.	#1, #2, #3, #4	Upper rt. max. sinus. #2.
Type of pain as described by patient.	Severe pain. Persistent until relieved.	Severe. Sudden onset type.	Severe ache	Severe ache increasing on descent.	Felt like something broke loose @ 15,000'.	Severe ache increasing on descent.	Sharp pain. Sudden onset.	Intense ache increasing on descent.
Altitude, ascent, or descent.	D 18,000'	D 17,000'	D 25,000'	D 14,000'	D 18,000'	D 17,000'	D 30,000' FF	D 18,000'.
How relief was obtained.	Valsalva @ 8,000'.	Spontaneous @ 15,000'.	Polit. @ 18,000'	Polit. post. run	Spontaneous @ 15,000'.	Polit. post. run	Valsalva @ 18,000'.	Polit. post. run.
History by patient.	Sinus dr. for past 8 yrs. Post nasal drip.	Sinus trouble 1 year ago. Slight cold ever since.	Sinus dr. for past 3 yrs. No cold.	No sinus trouble. No cold.	Sinus trouble past 3 yrs. No cold. No sinus trouble since run.	No sinus trouble. Has cold.	Sinus trouble for past 8 yrs. Has sl. cold.	No sinus trouble. No cold.

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TABLE 1.—*Compiled data on cases of aerodontalgia and cases presenting major dental pathology without aerodontalgia*—Continued

Case No.	47	48	49	50	51	52	53	54
Non-path. fillings.	#3 MO-am. c̄ cem. base. #4 O-am.	#2 MOD-am. #5 DO-am.	None	#15 MO-am	#12 DO-am; #14 O-am.	{#13 O, #14 O, #15 O, #16 O} am	#2 O-am.	#3 MO-am.
Pathological findings including x-ray.	X-ray neg.	#3 MO-cav. #4 MOD-cav. c̄ pulpal involvement.	No cavities. X-ray neg.	#12 O-cav. X-ray neg.	X-ray neg.	X-ray neg.	#1, #4 missing. X-ray neg.	#1 missing. No other pathology.
Previous trouble.	None	None	None	None	None	None	None	None.
Previous runs and actual flights.	No PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.	No PCR. No act. fl.
Treatment since first run.								

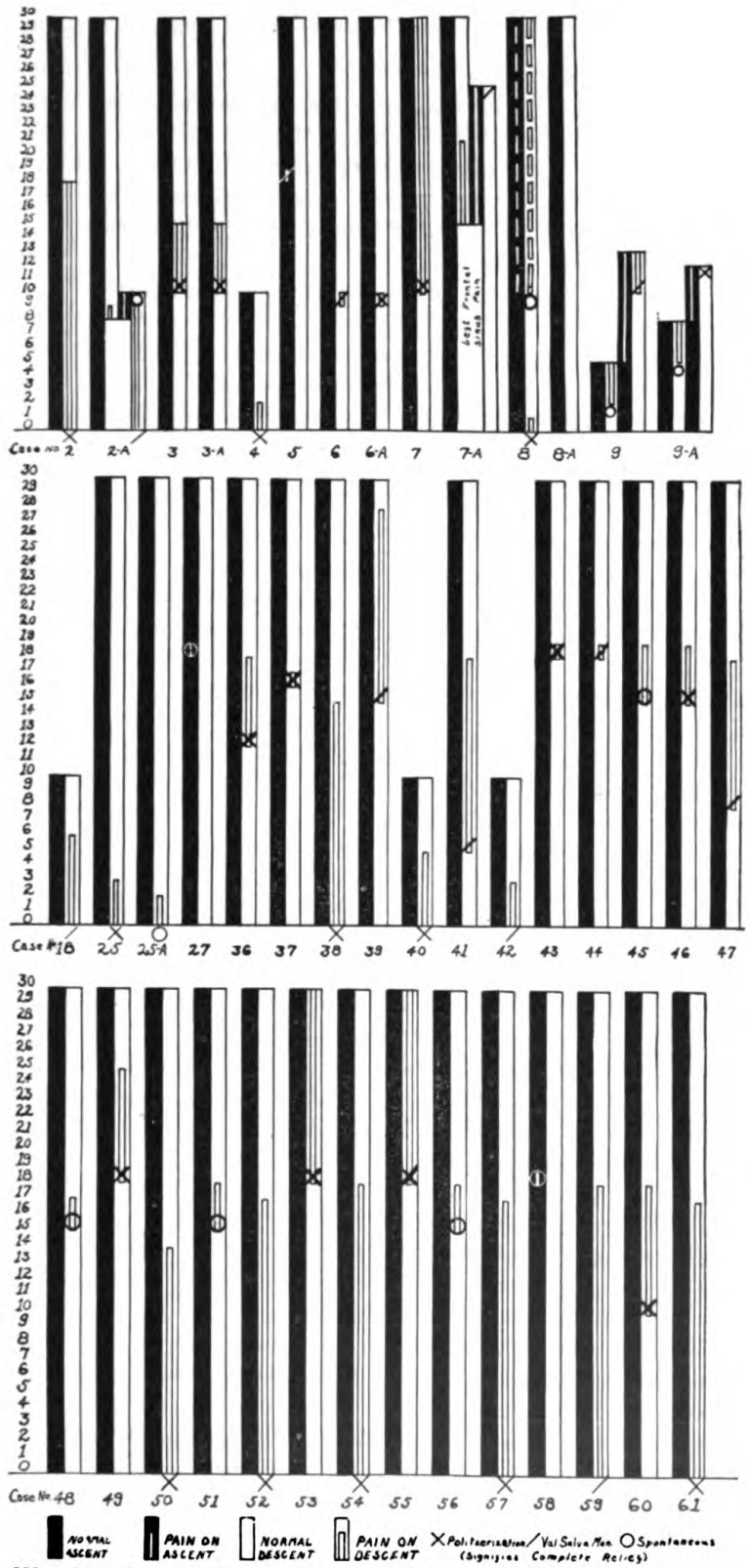
Case No.	55	56	57	58	59	60	61
Pain	Yes	Yes	Yes	Yes	Yes	Yes	Yes.
Location of pain	#15	#3	Upper rt. post. teeth. Rt. max. sinus.	#3	#14	#3. Upper rt. max. sinus.	#12, #13.
Type of pain as described by patient.	Sharp pain. Sudden onset.	Felt like something broke loose @ 15,000′.	Intense ache increasing on descent.	Severe sharp pain lasting for few seconds.	Intense ache increasing on descent.	Severe pain. Persistent.	Intense ache increasing on descent.
Altitude, ascent, or descent.	D 30,000 FF	D 18,000′	D 17,000′	A 18,000′	D 18,000′	D 18,000′	D 17,000′.
How relief was obtained.	Valsalva @ 18,000′	Spontaneous @ 15,000′.	Polit. post. run	Spontaneous @ 18,000′.	Val salva post. run	Polit. @ 10,000′	Polit. post. run.
History by patient	Sinus trouble all his life. No cold.	Sinus trouble for past yr. No cold.	Sinus trouble for 8 yrs. No cold. #1, #2, #4 ext. 8 yrs. ago.	No sinus trouble. Slight cold.	Sinus dr. for past 10 yrs. No cold.	No sinus trouble. Has cold.	Sinus trouble all his life. No cold.
Non-path. fillings	None	#2 MO-am; #3 O-am.	None	#2 MO-am; #3 O-am; #4 MOD-am; #5 O.	#13 O-am; #15 DO-am.	#4 O-am	#12 O-am; #14 DO-am.

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Pathological findings including x-ray.	All teeth present and erupted. No pathology.	#1 missing; #4 O-cav.	#1, #2, #4 missing. X-ray neg. No fillings or cavities in #3-#5.	X-ray neg	#14 O-cav. X-ray neg.	No cavities. X-ray neg.	#15 O-cav. X-ray neg.
Previous trouble	None	None	None	None	None	None	None.
Previous runs and actual flights.	No PCR. No act. fl	No PCR. No act. fl	No PCR. No act. fl	No PCR. No act. fl	No PCR. No act. fl	No PCR. No act. fl	No PCR. No act. fl.
Treatment since first run.							

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TABLE 2.—*Correlation of the onset, duration, and method of relief of aerodontalgia with altitude in subjects experiencing pain.*



[Numbers in columns at left show altitude in thousands of feet.]

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TABLE 3.—*Consolidated data*

	Number	Percent
1. Incidence of aerodontalgia:		
(*a*) Total number of individuals run in low pressure chamber from 26 September 1942 to 1 May 1945	3,438	
(*b*) Cases in (1 (*a*)) of aerodontalgia recorded	63	1.86
(*c*) Total number of individuals given oxygen indoctrination runs in low pressure chamber from 1 October 1944 to 1 May 1945	920	
(*d*) Number of individuals in this group (1 (*c*)) experiencing aerodontalgia	37	4.02
(*e*) Of number in (1 (*d*)) those occurring on ascent	5	13.5
(*f*) Of number in (1 (*d*)) those occurring on descent	32	86.4
(*g*) Number of times aerodontalgia occurred in 37 individuals	42	
2. Influence of age:		
(*a*) Age range (1 (*d*)) 19–36.		
(*b*) Average age (1 (*d*)) 24.		
3. Recurrence of aerodontalgia in 1 (*d*):		
(*a*) Number (1 (*d*)) available for repeat runs	7	18.9
(*b*) Number (3 (*a*)) having recurrence of aerodontalgia	5	71.4
(*c*) Number (3 (*a*)) in which dental pathology had been corrected between first and second runs	3	42.8
(*d*) Number of these (3 (*c*)) who had recurrence	2	
4. Location of pain:		
(*a*) Number of those (1 (*d*)) who reported pain to be localized in particular teeth	25	67.5
(*b*) Number of those (1 (*d*)) who reported pain to be generalized in a particular region	12	32.4
(*c*) Number of those (1 (*d*)) reporting pain either in teeth approximating the maxillary sinus or in the region of the maxilla	35	94.5
(*d*) Number of those (1 (*d*)) who had pain localized in other teeth	2	5.4
5. Subjective report of severity of pain:		
(*a*) Number of instances of aerodontalgia (1 (*g*)) described as severe	32	76.2
(*b*) Number (1 (*g*)) described as a "dull ache"	10	23.8
(*c*) Number (1 (*g*)) described as of sudden onset	14	33.3
(*d*) Number (1 (*g*)) which were persistent through considerable range of pressure change	30	71.4
(*e*) Number (1 (*g*)) which were of short duration	11	26.2
(*f*) Number (1 (*g*)) described as intermittent short "flashes" during a long pressure change interval	1	2.3
6. Abnormalities in region where pain was experienced:		
(*a*) Number of instances (1 (*g*)) in which cavities were present	9	21.4
(*b*) Number (1 (*g*)) who presented fillings in teeth involved or immediately adjacent	35	83.3
(*c*) Number (1 (*g*)) who presented major dental pathology	5	11.9
(*d*) Number (1 (*g*)) in which teeth were missing	13	30.9

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TABLE 3.—*Consolidated data*—Continued

	Number	Percent
7. Case history:		
(*a*) Number of those (1 (*d*)) giving definite history of maxillary sinusitis or present upper respiratory infection	29	78. 3
(*b*) Number of those (1 (*d*)) who gave no history of these conditions	8	21. 6
8. Association of aerodontalgia with maxillary sinus pain:		
(*a*) Number (1 (*g*)) experiencing concomitant maxillary sinus pain	16	38. 1
(*b*) Number (1 (*g*)) not experiencing concomitant maxillary sinus pain	26	61. 8
9. Relief of pain:		
(*a*) Number (1–(*d*)) relieved by politzerization	21	57. 1
(*b*) Number (1–(*d*)) relieved by Valsalva Maneuver	10	26. 1
(*c*) Number relieved spontaneously	6	16. 6
10. Recent fillings (less than 60 days) and untreated cavities present in 920 (1 (*c*)) individuals:		
(*a*) Total recent fillings present at time of run	256	
(*b*) Deep-seated fillings with or without protective base	95	
(*c*) Recent fillings in upper bicuspid and molar teeth	113	
(*d*) Total cavities present at time of run	211	
(*e*) Deep-seated cavities approximating the dental pulp	91	
(*f*) Deep-seated cavities in upper bicuspids and molars	43	
11. Incidence of frontal sinus block in this series:		
(*a*) Number (1 (*c*)) experiencing frontal sinus pain	28	3. 04
(*b*) Number of those (11 (*a*)) occurring on ascent	3	10. 71
(*c*) Number of those (11 (*a*)) occurring on descent	25	89. 29
12. Incidence of ear block in this series:		
(*a*) Number (1 (*c*)) experiencing ear block	142	15. 4

CASE HISTORY OF AERODONTALGIA OCCURRING DURING MILITARY OPERATION

Name _____ Rank _____

Age: 24 years. Color: White Sex: Male.

Chief complaint

Patient complains of frequent severe pains in the region of both frontal sinuses, the left maxillary sinus, and upper left posterior teeth during rapid descent from 13,000 feet in aircraft.

Present history

Pain begins in the forehead over the right and left frontal sinuses and progresses through the region of the left eye and downward to the left maxillary sinus and teeth of the upper left posterior quadrant. The pain in the maxillary sinus and teeth remains for a period of from 2 to 3 hours, while the frontal sinus pain persists, usually, throughout the following day, gradually decreasing in magnitude.

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The onset of the pain is manifested by a gradually increasing "stuffed feeling" in the "nose" and sinuses during ascent (usually to 13,000 feet) in aircraft. The pain becomes so severe during rapid descent that at times "I had to be relieved of control of the plane by my copilot."

On many occasions the patient had to request the remainder of his squadron to descend at a much lower rate and, in some instances, it was necessary for him to leave his squadron during flights of strategic importance because of the severity of pain. He states that this condition was, in large measure, responsible for his return to the United States.

If descent is made at a rate of less than 500 feet per minute, the patient is able to obtain relief by means of the Valsalva Maneuver. Oxygen is used at all times above 10,000 feet and above 8,000 feet during night flying. Partial relief is obtainable by re-ascent to an altitude above that at which the pain occurs.

Past history

Patient states he has had a "chronic catarrhal condition" for the past 8 years. He was not aware of sinus pain until after beginning his flying career. The patient states that his sinus trouble has become increasingly worse since he has been flying at medium high altitudes. The sinus and tooth pains became extremely severe after 29 April 1944, at which time he began piloting a medium dive bomber in the Pacific theater of operations.

During his flight training 2 oxygen indoctrination runs in the low pressure chamber were made uneventfully. There is no history of surgical or other type of treatment regarding the nose or paranasal sinuses.

Family history

Father and mother living and well. One brother who has severe frontal sinusitis.

Social history

Irrelevant.

Clinical examination

The frontal, ethmoidal, maxillary and sphenoidal sinuses are radiographically clear, and clear on transillumination.

The upper left third molar tooth is impacted mesioangularly, and the lower third molar tooth is impacted horizontally.

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MALARIA IN PANAMA

THEODORE H. NOEHREN
Lieutenant (MC) U. S. N. R.

Malaria and Panama have been practically synonymous terms since the digging of the canal. Great advances have been made since the days when Gorgas tackled the tremendous problem. The disease now, from a statistical standpoint, has assumed a minor role.

The defeat of malaria, however, has not been as complete as that of yellow fever, and the disease, with all its treacherous implications, still exists. This is, and will undoubtedly continue to be, of special importance to Naval medical personnel.

A study of the admission diagnosis of malaria patients in a naval hospital in Panama would suggest that the disease and its importance bears re-emphasis at this time.

TABLE 1.—*Admission diagnoses of 147 patients with malaria admitted to a Naval hospital in Panama, from 1 November 1943 to 15 June 1945.*

Malaria	42
Diagnosis undetermined (malaria)	64
Catarrhal fever, or diagnosis undetermined (catarrhal fever)	13
Medical observation	14
Pneumonia, or diagnosis undetermined, (atypical pneumonia)	6
Urological observation	3
Gastro-enteritis	1
Jaundice	1
Acute appendicitis	1
Serum sickness	1
Acute pharyngitis	1

TABLE 2.—*Admission diagnoses of 49 patients where malaria was suspected but not found, during this same period.*

Malaria	6
Diagnosis undetermined (malaria)	43

It is significant to note that of 147 malaria patients treated at the Naval hospital only 28.5 percent were admitted with the correct diagnosis. About half of these were recurrent, many veterans of Guadalcanal, who could diagnose their disease from previous experience. In 43.5 percent the diagnosis of malaria was considered but was not definitely established. Almost 28 percent of the patients, or over one-fourth, were admitted under a diagnosis which gave no suggestion of malaria.

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On the other hand, 6 patients were sent to the hospital diagnosed malaria and 43 were sent in under Diagnosis undertermined (malaria). in which the disease could not be established, and finally other diagnoses were made. All patients totaled represented approximately 3 percent of the over-all admissions to the hospital during that period.

The situation would not be so significant if it were not for the fact that the only death from malaria among Naval personnel during that period (not in this series) occurred in a man who, after 2 to 4 days of symptoms, was admitted to a hospital with the diagnosis of bronchitis, acute. The diagnosis of malaria, malignant tertian, was made the following day when the blood film showed from 75 to 100 parasites per oil immersion field. That same afternoon the man became comatose, and, in spite of atabrine and intravenous quinine, died 32 hours after entering the hospital.

The necessity of a correct, early diagnosis is also emphasized by Kean and Smith (*1*). In their analysis of 100 patients who died from malaria in this region, 23 of them had symptoms of not more than 1 day before admission to a hospital, and yet they died.

The reported admission figures must be evaluated in a less critical light when it is realized that some of these patients were hospitalized by hospital corpsmen on independent duty. They quite routinely use a "D U" diagnosis. Some of the admission notes in the health records showed that malaria was considered when the admission diagnosis did not include it, though many of them did not mention the examination of a blood smear.

Definite evidence of malaria in a blood smear is frequently difficult to find. Some experience in slide interpretation is usually necessary. Certain aids, though, are recommended which would increase the number of early positive diagnoses and prevent delay in treatment. Hospital laboratories, both military and civilian, which see the most malaria in this area can more frequently be of valuable assistance. Smears from patients suspected of having malaria in any part of the area could be taken to these laboratories for staining and examination. This would avoid delay in diagnosis and temporizing until symptoms develop to where hospitalization becomes urgent.

The hospital laboratories provide an easy opportunity for informal instruction in the diagnosis of malaria and other tropical disease. Hospital corpsmen and medical officers, on whom the early diagnosis depends, should more frequently avail themselves of this opportunity.

Malaria in Panama is probably not much different from the disease elsewhere (*2*). Our series of 147 patients includes 104 in whom the organism was *Plasmodium vivax*, 39 in whom it was *Plasmodium falciparum*, 3 in whom it was *Plasmodium malariae*, and 1 in whom it was unclassified. In one patient there was concurrent onset of

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"coca-cola" colored urine with the malaria. Routine therapy, atabrine in this case, brought about uneventful recovery.

In Panama, as elsewhere, the diagnosis of malaria rests primarily on a blood smear and a high index of suspicion. The application of this suspicion may be carried to the extent that all patients with systemic complaints automatically have a blood smear examined. Or it may indicate that all febrile patients in such an area deserve a smear, as is the procedure in some of the hospitals in this region. It must be remembered though, that malaria patients are not universally febrile.

Any symptom can suggest malaria to the thoughtful examiner. Here, similar to other areas (*3*), the infection shows up with bizarre symptoms simulating, like syphilis, almost every known disease of the body. There are, however, certain complaints which are strongly indicative of the disease. These have been present consistently enough in our cases that, in their presence, the ward hospital corpsmen make a remarkably accurate diagnosis before the smear is reported.

These symptoms are:

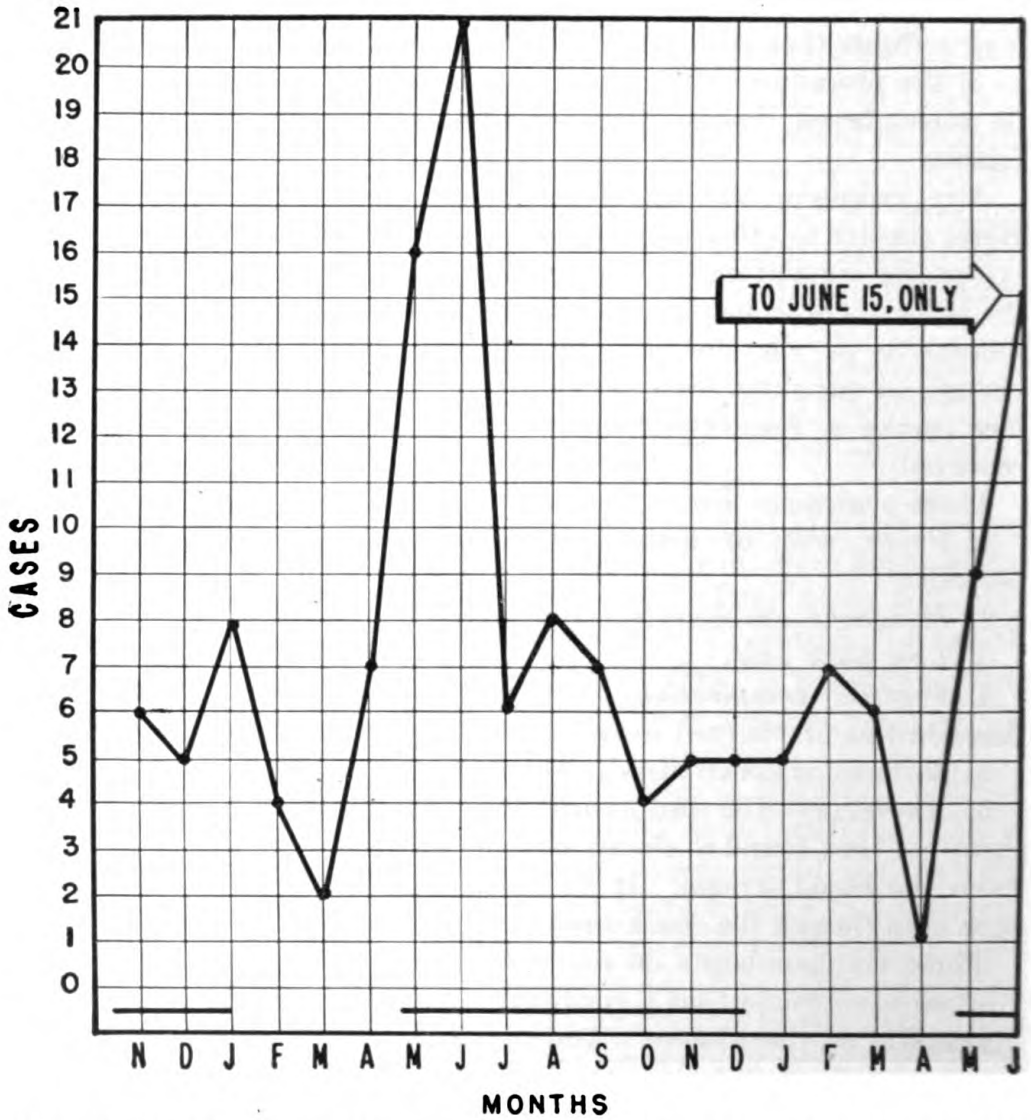
1. *Fever*, with or without preceding chills, and not necessarily periodic.
2. *Headache*, characteristically retrobulbar or frontal.
3. *Low back pain.*
4. *Profuse perspiration*, with an unusual odor. It has been described as of "burned matches," "phosphorus," "sulfur," etc.
5. *Malaise*, of unexplained, sudden onset.
6. *Anorexia.*—The disappearance of this symptom following treatment has been found to closely parallel the disappearance of parasites from the blood stream. It has sometimes indicated an incomplete cure even though the check smears may be reported as negative.

These six complaints do not cover the symptomology of malaria. But we have found that a combination of any four of these is fairly diagnostic of the disease. Additional suggestive signs are a pulse comparatively slow for the extreme fever, and an appearance of relative well-being even in the presence of a high fever (a contrast to the appearance of patients with high fevers of bacterial or other origin). A fairly normal sedimentation rate, a normal leukocyte count, and especially a leukopenia with a shift to the left, or relative increase of monocytes, are still more findings pointing to malaria.

Certain other factors are of help in detecting malaria in Panama. It is well known to "old timers" of the medical and nonmedical personnel of the Zone, that some particular regions, accessible to servicemen in Panama, are noted for the heavy incidence of malaria. In a recent warning (*4*) to civilians it was pointed out that of 34 patients

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in a nearby hospital, 25 were individuals who spent time at one resort area. A knowledge of these endemic spots can be gained easily from the Panama-Canal Department of Health, or from personnel who are established here.



Admission of 147 malaria patients in Panama according to months. (Horizontal lines at base indicate approximate time of rainy season.)

Another aid to the suspicion of malaria is the definite periodicity of cases in Panama. The rainy season starts here the first part of May and continues through the first part of December. Malaria occurs in all months but is most prevalent during the wet season, as elsewhere in the world. Recurrent cases, too, for some unknown reason, are more frequent in the wet season. In our series malaria was seen to be most prevalent at the *onset* and *conclusion* of the rainy season.

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A still larger cycle in the incidence of malaria in Panama has been suggested. Clark (*5*) has reported that an annual variation in the incidence of malaria, even in uncontrolled areas of the country, has been noted here, suggestive of the 5-year cycle of Puerto Rico. The time phases are not very regular in Panama, but it is certain that the period included in our 19-month series was during a definite depression in the larger cycle.

Proximity of personnel to known malaria patients, especially in those men living off Naval reservations, has been a valuable adjunct in diagnosis. In one recent instance, the wife and 5 children of a Filipino chief cook were admitted to a civilian hospital with malaria. A blood film, taken from the chief on that basis revealed a heavy parasitemia though the man denied previous symptoms.

Further aid in the suspicion of malaria is the patient's conviction that he has the disease. This is especially true of recurrent cases. In men who have had previous attacks, the diagnosis has been consistently accurate when he says he feels he has malaria again. This has proved quite helpful.

There are, unfortunately, certain factors in Panama which offer difficulty to the diagnosing of malaria. The so-called "tropical fevers" of unknown etiology are sufficiently frequent and resemble malaria closely enough to make differential diagnosis difficult.

The so-called "Panama fever" has been publicized enough to become a real entity in the minds of many. A rather earnest attempt, however, to find a definition of "Panama fever" among the established medical men here, and in the periodicals of this region, has met with little success. Clark (*6*), in analyzing the "imperfectly differentiated fevers of the Isthmus," fails to define any single disease entity which could be called "Panama fever." The term is used frequently enough, however, to cause concern in the mind of a medical officer new in this region and faced with a febrile patient.

There are fevers of unknown etiology frequently seen in Panama but the only reports of cases similar enough to be grouped as separate entities are those by Deeks (*7*) in 1912, and by Fairchild (*8*), (unpublished), both of which reported short-lived epidemics. A number of patients with fever of unknown nature, have been seen in the 19 months during which these malaria patients were observed. In them, the chief complaint was high fever, sustained for from 4 to 7 days, after which it spontaneously subsided with no further recurrence. The blood counts, sedimentation rates, physical findings (including splenomegaly) and general appearance of the patients, closely resembled malaria. Blood smears twice a day for 3 days, as is our routine in such cases, were all negative and recovery occurred without specific medication.

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Some of these patients with atypical fever were seen to recover quickly following small does of atabrine. In that regard, a warning should be given here that a "therapeutic trial" can be a misleading path to the diagnosis of malaria. It is very important that every effort be made to find the parasites as was done in each of the 147 patients in this series. Without this diagnostic support an incorrect assumption of the disease, with all its implications for the patient's future, may be made.

A "therapeutic trial" can be misleading in the other direction as well, even to the point of abandoning the diagnosis of malaria when it is correct. In some of our patients a convincing response to atabrine did not occur until 2 or 3 days after onset of treatment. With quinine the reaction is more prompt but not always immediate. What is more, an aggravation of symptoms and temperature to a point higher than any time previous to admission quite often has been seen the day after medication was started. This may happen regardless of what phase of the fever cycle that particular day may be. This has been explained by some as the result of a contraction of the spleen and other organs harboring parasites, in response to therapy.

Another confusing factor in Panama is the frequent association of pneumonitis with malaria. Applebaum and Shrager (*9*), from the Gorgas Hospital, reported a series of 125 consecutive patients here in which pneumonitis was concurrent with malaria. In our series of malaria patients we had six who were admitted as pneumonia or diagnosis undetermined (pneumonitis). The definite admission diagnosis of atypical pneumonia in some of our malaria patients suggests the association of such findings. In other patients with proved malaria definite fine râles, especially in the hilar areas, are noted.

Further difficulty in diagnosing malaria, especially among military personnel, is the lack of so-called "classic" symptoms which have been axiomatic for so long. Periodically recurrent chills and fever, secondary anemia, and splenomegaly are taught as the classic triad of malaria (*10*). These symptoms are now known to be prominent in chronic or long-standing infections and are not so common in new ones.

The access which military personnel have to medical attention frequently delivers a patient with malaria into medical hands before these "textbook" signs develop. In many instances the time cycle of the parasites has not yet been coordinated to give the 3-day or 4-day fever picture. Nor has the cycle been repeated enough to cause the red cell destruction of secondary anemia. Moderate enlargement of the spleen, while seen frequently, has not been present consistently enough to be considered as necessary for a definite diagnosis of malaria.

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We have used a method of percussion which has helped considerably in detecting splenomegaly. To outline the whole organ by percussion is sometimes difficult even in the natives in whom enlarged spleens are so prominent. Gentle percussion at the left costal margin before and at the height of deep inspiration will frequently reveal comparative dullness on inspiration. In this way splenic enlargement has been detected which could not be palpated.

All matters considered, however, the diagnosis of malaria in Panama, as elsewhere in the world, rests upon a high index of suspicion. Military medical personnel must carefully watch for its presence.

SUMMARY

1. An analysis of admission diagnoses of 147 patients with malaria treated at a Naval hospital in Panama shows that only 28.5 percent were definitely diagnosed before admission, 43.5 percent were admitted Diagnosis undetermined (malaria), and 28 percent were sent to the hospital under a diagnosis not suggesting malaria. There were also 49 patients admitted under an established diagnosis of malaria or Diagnosis undetermined (malaria), which could not be substantiated.

2. Prominent chief complaints have been fever, retrobulbar headache, low back pain, perspiration of unusual odor, sudden malaise, and anorexia. A combination of four of these is considered highly indicative of malaria.

3. Factors which aid in the diagnosis of malaria in Panama are: Exposure of individuals to known endemic spots, predominence of new cases at either end of the wet season, and proximity to known cases.

4. Factors making for difficulty in diagnosis of malaria in Panama are: Tropical fevers which closely resemble that disease, the misleading results of a "therapeutic trial," and the infrequency of the "textbook" signs, i. e. periodic fever, secondary anemia, and splenomegaly.

5. Diagnosis of malaria in Panama rests almost entirely on a high index of suspicion and a blood smear.

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EFFECT OF PROACTINOMYCIN ON *STAPHYLOCOCCUS AUREUS* IN HEART BROTH

Proactinomycin in low concentrations lengthens the lag phase of the Oxford staphylococcus, and in certain media this increase in the lag becomes greater as the size of the inoculum is reduced. The prolonged lag obtained with small inocula is greatly decreased by filtrates from young cultures. It is considered that one of the primary effects of proactinomycin is an interference with the synthesis or use of diffusible substances produced by the cells and concerned with the ending of lag.

The length of the lag is increased considerably by raising the concentration of the antibiotic, but within a certain range the rate of division when logarithmic growth has set in is affected only to a minor extent. It appears as though a certain portion of the growth mechanism was relatively insensitive to proactinomycin.

When the concentration of proactinomycin is increased above a certain value its effect on the staphylococcus is of a different kind; after a period of incipient growth the cells then begin to die. In this respect there is a qualitative similarity between the effect of proactinomycin and that of penicillin.—ABRAHAM, E. P.: Effect of proactinomycin on *Staphylococcus aureus* in heart broth. British J. Exper. Path. 26: 349–356, October 945.

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PARTITIONING OF BARRACKS

EFFECT ON MORBIDITY RATES FROM RESPIRATORY DISEASE

The Personnel of
EPIDEMIOLOGY UNIT NO. 22[1]

The effect of partitioning of barracks on the morbidity from respiratory disease at a large Naval training station is discussed in this article.

In 1943 studies were done at another Naval training station suggesting strongly that the less men per room the smaller was the morbidity from respiratory disease, whereas there seemed to be no relation between cubic feet of air space or square feet of floor space per man to morbidity.

With this in mind, in 1944 at another naval training station, one-half of the barracks in each of 2 camps were divided by cloth partitions. These partitions were placed in such a manner that they divided each deck of a barracks into 14 compartments. The ends of these compartments opened into a wide central passageway and the partitions were approximately 2 feet above the heads of the men sleeping in the upper bunks, but did not extend to the overhead. They could be pulled back out of the way. The men slept with the bunks at right angles to the passageway, but the individual partitions were not sufficiently long to prevent the ends of the second row of bunks in each compartment from jutting into the central passageway next to the beds of the men in the adjoining compartments.

From 10 to 12 men were placed in each compartment. For a period of 6 weeks, morbidity rates were followed in these recruits and among a number of men in smilar barracks not so partitioned. These were approximately 5,000 men in the compartmented group and an equal number in the control group.

Over the 6-week period there was no significant difference in the illness rates in the two groups.

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[1] Members of Epidemiology Unit No. 22 during the period of this study were: Commanders Donald C. Young (MC), U. S. N. R.; Burtis B. Breese, Jr. (MC), U. S. N. R.; Allison F. Errington (MC), U. S. N. R.; and Walter Stoeffler (MC), U. S. N. R.; Ensigns Fredrick A. Zuelzke (HC), U. S. N., Leroy V. Grussendorf H(S), U. S. N. R., and Russel R. Harrison (HC), U. S. N.; Chief Pharmacist Grove G. Wiley, U. S. N.; Chief Pharmacist's Mate Edward L. Warmanen, U. S. N. R.; pharmacist's mates, first class, Carl E. Johnson and Peter Packet, U. S. N. R.; pharmacist's mates, second class, Fred W. Elias, Samuel W. Pollock, and Rufus Thompson, U. S. N. R.; and pharmacist's mate, third class, Herbert M. Stevenson, U. S. N. R.

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It was felt that there were at least two reasons why this type of partitioning was not effective. First of all, the curtains were not kept drawn for much of the time that the morbidity figures were studied. Secondly, because the bunks near the central passageway jutted into it and the heads of men in adjoining compartments were often next to each other.

In short, the partial compartmentation of barracks for recruits in the manner described had no noticeable effect on illness rate.

Later in the year, funds were made available for the construction of more permanent types of partitions and such partitions were constructed in every other barracks in two other camps (A and E). These partitions were made of wood or fiber-board and extended from the decks to within 2 feet of the overhead, and were placed from the outer bulkhead toward the central passageway, as were the cloth partitions. In this case, however, they extended far enough toward the center so that the end bunks of men in adjacent compartments were separated by the partitions.

The effect of such partitioning on illness was judged by the admission rates for catarrhal fever, scarlet fever, tonsillitis, and pharyngitis. The period of observation covered in Camp E was 11 weeks, and in Camp A was 7 weeks. The average daily population in each group was approximately 2,500.

As noted in the table, the morbidity rates were higher, if anything, in the partitioned than in the nonpartitioned barracks.

Illness rates in partitioned and nonpartitioned barracks

CAMP A

	Partitioned		Not partitioned	
Population [1]	36,183		34,202	
	Cases	Rate [2]	Cases	Rate [2]
Catarrhal fever	28	282	20	213
Tonsillitis and pharyngitis	101	1,020	75	798
Scarlet fever	12	121	8	85

CAMP E

	Partitioned		Not partitioned	
Population [1]	112,195		95,613	
	Cases	Rate [2]	Cases	Rate [2]
Catarrhal fever	89	288	65	248
Tonsillitis and pharyngitis	125	406	126	488
Scarlet fever	31	100	13	49

[1] Man-exposure days.
[2] Rate per 1000 per year.

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DISCUSSION

These studies show that in this activity partial compartmentation of barracks had no effect on illness rates of certain respiratory diseases.

This, however, does not necessarily vitiate the observation that smaller numbers of men in a room may be of value in prevention of illness. It merely shows that compartmentation of the type described has, on the basis of this experience, no value in prevention of illness in naval recruits. It is of course possible that the method might have some value in the prevention of illness if the communicability of the organism was less or if the barracks were divided into rooms.

In any case, this method of control of infection was of no value under the conditions encountered.

SUMMARY

Partial compartmentation of barracks with both wooden and cloth partitions was attempted as a means of control of respiratory illness. This method had no apparent value in the large Naval training station where it was used.

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FRACTURES OF THE SHAFT OF FEMUR[1]

EARLY TREATMENT ON A HOSPITAL SHIP

HAROLD LUSSKIN
Commander (MC) U. S. N. R.
and
RICHARD R. HOFFMAN
Lieutenant Commander (MC) U. S. N.

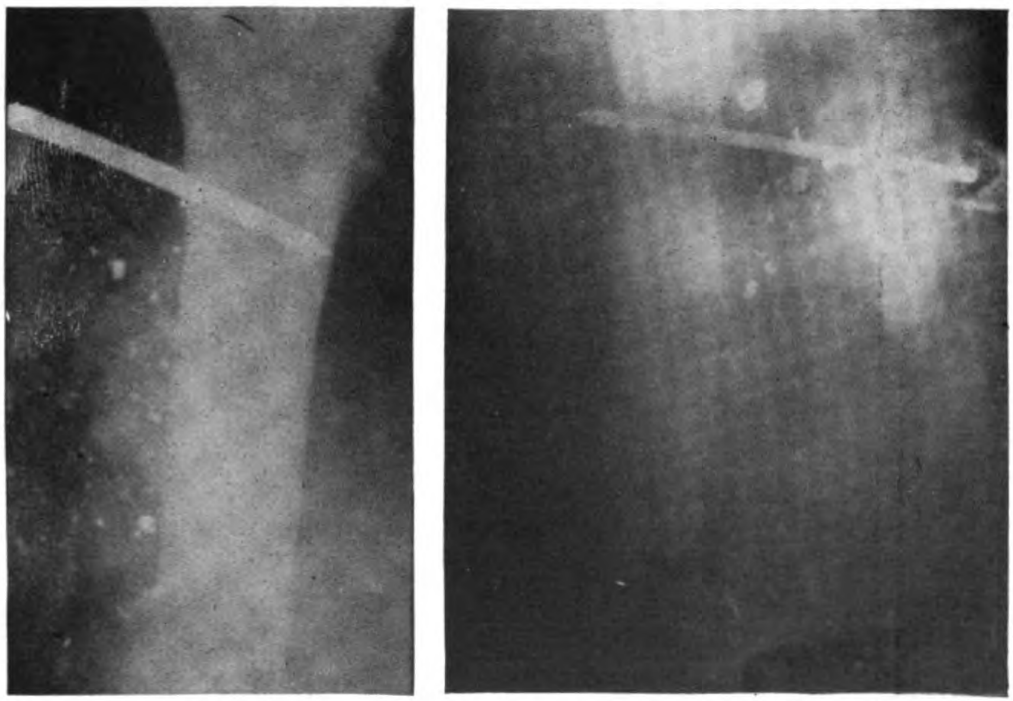
While picking up casualties sent to this hospital ship from the beaches, shore hospitals, and other ships during and following a landing operation and action, we were impressed by the large number of fractures of the femur received. They were brought aboard in Thomas splints with considerable windlass traction, in tight plaster of paris spica casts, both double and single, in a combination of Thomas splint and traction incorporated in a plaster cast, or simply in Stokes stretchers without traction or any other form of support. Many of those in spica casts had a pin through the lower part of the femur, and some also had a stirrup and windlass attached. Most of the patients had large ragged wounds extending down to and through the bone. Because of the number of casualties and the extreme difficulties under which treatment was given before these men reached the ship, it was remarkable that any form of adequate treatment could be given under the circumstances.

In considering the mode of treatment to be instituted, it was necessary to keep in mind that the patients were on a ship, that there were only narrow bunks in tiers of two and three, with very little space between bunks. It was also necessary to remember that at any moment it might be necessary to evacuate the patients from the ship, possibly in a great hurry. A ship rolls and pitches, causing anything not lashed down or fixed to swing or slide. Consequently elaborate methods of traction in fracture beds were out of the question. The weights would swing and the patient roll, disturbing bony alinements. Evacuation of a patient in traction without causing pain or disturbing the position of the bone fragments is almost impossible, especially from a hospital ship to smaller craft. That meant that Russell traction or skeletal traction could not be used.

[1] Received for publication May 1945.

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The use of some form of direct bone fixation, such as advocated by Roger Anderson, Stader, Haines, and numerous others, was considered, but here again serious drawbacks arose. The apparatus would have to leave the ship with the patient. Since the number of fractures requiring this form of treatment was very great, the ship would rapidly be depleted of the apparatus and splints in an area where new equipment could not be obtained and the number of fractures of all kinds ran into the hundreds. The use of bone plates also had to be discarded for all the fractures were compound, most of them extensively comminuted, and surely contaminated. In many instances two-thirds of the bone was shattered. Many of the wounds were multiple and very large, requiring vaselin-gauze or other forms of dressings and casts for protection of the soft tissues.



1. The upper pin is passed from the outer side of the thigh, inward through the outer side of the femur and either into or just through the cortex of the bone on the inner side. The pin should extend 3 or even 4 inches beyond the skin and should be incorporated in the cast.

No cast, however well applied, will hold a fractured shaft of the femur in the middle two-thirds for any length of time. In the vast majority of cases the fragments will slip as soon as atrophy takes place and some play develops between the thigh and the cast. Some extra help is necessary. In upper shaft fractures where the proximal fragment was abducted and flexed, the lower fragment could not be brought up and out to meet it, because the limb would obstruct the passageway between bunks; also the patient could not be turned on his back or abdomen because of the limited space in the tier.

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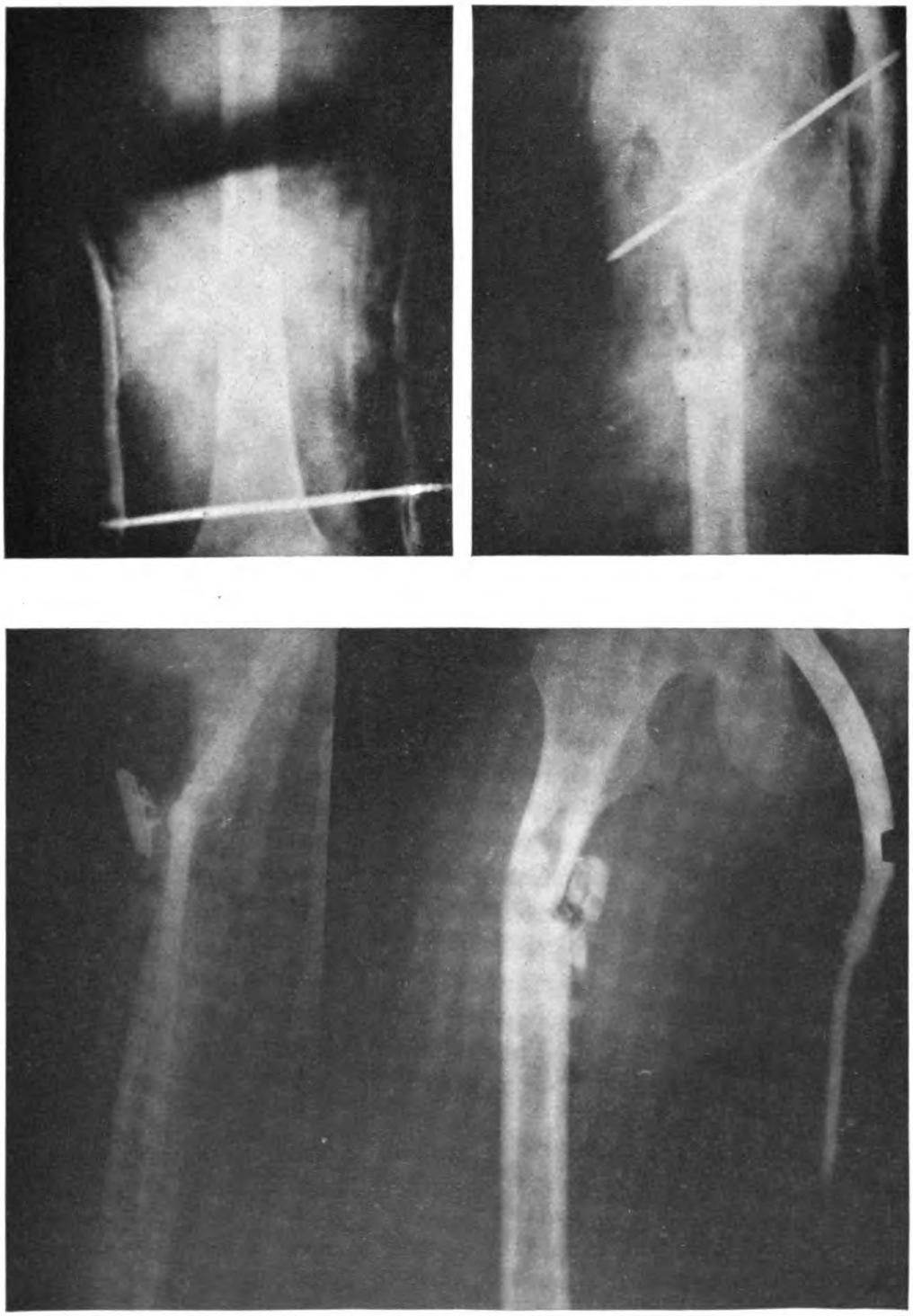


2. When the fracture is high, the upper pin is passed through the greater trochanter downward and inward into or just below the lesser trochanter.

A procedure to meet all these objections utilized a combination of the plaster of paris cast with full and half pins. By full pin is meant one which passes entirely through the limb and bone. The half pin was passed from the outside of the thigh, through the cortex on the outer side of the femur and either just into or just through the cortex on the inner side. The lower pin was passed through the femur just above the condyles if local conditions in the thigh permitted, or through the upper tibia if conditions did not permit. The upper pin was passed above the fracture site from without inward but only just through the cortex on the inner side of the femur. The wounds were gently washed and irrigated with sterile saline solution and a non-irritating soap and minimally debrided, then very lightly packed with vaselin gauze, and dry or vaselin gauze over all. As this was done on an orthopedic table, traction could be applied as soon as necessary and feasible. The lining up of the fragments presented a problem. Adequate traction most often corrected the lateral displacement of the bones except in cases with a short upper fragment. The distal fragment, however, usually flexed. By suspending the lower and upper fragments in slings, they could easily be lined up visibly through the use of the fluoroscope and the position maintained by the slings and traction. It was then a simple matter to incorporate the pins in a plaster of paris spica cast from the lower ribs to the lower third of the leg. As soon as the cast was firmly set, the traction was released, and the foot and lower part of the leg were included in the plaster. The slings were then removed and the holes in the cast covered.

The leg did not have to be abducted more than 20 degrees. The cast had to extend from the toes to the mid-chest to prevent motion of the fragments. Even a short upper fragment could be manipulated and brought into proper alinement without having to abduct the leg greatly after the half pin was in place. The patient was now adequately immobilized. The fragments would not slip, and length was constantly maintained. Steinmann pin and all were enclosed firmly in the cast. The patient could then be evacuated easily if necessary, without fear, without loss of apparatus that could not easily be replaced, and without the need for elaborate equipment. The patient could be easily turned within the narrow confines of his bunk, even if he were in the lower or middle bunk of the tier of three. This method functioned smoothly for us with a very large number of fractures.

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3. This patient was a Japanese prisoner brought aboard in a Thomas splint. The wound was relatively small. The fracture was high in the femur. The upper half pin was passed somewhat too far, but without any damage. The position was corrected easily and maintained in the spica cast incorporating the pins.

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The site for the pins had to be chosen very carefully. Large wounds often prevented the placing of the pins where preferable. Often extreme shattering of the bone prevented pinning in the usual place, namely, the lower femur just above the condyles and the upper femur just below the trochanters. Occasionaly the upper pin had to be passed obliquely through the greater trochanter and into the lesser.

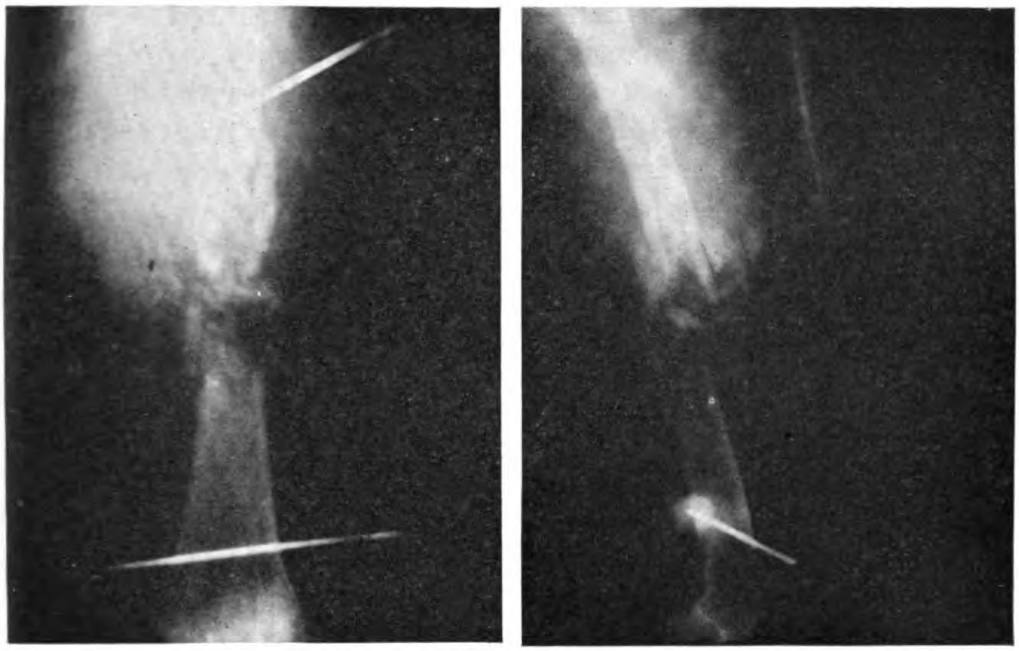
The fluoroscope was found to be an absolute necessity in this procedure. Its use prevented many trips to the operating room to correct original malalinements. Because of the frequent use of the fluoroscope some protection had to be improvised for the patient and the operator by the roentgenologist. Briefly the equipment consisted of a portable fluoroscope with a long narrow metal cone to prevent scattering of the rays and to cover a relatively small field. An ordinary leaded apron was suspended between the thighs of the patient. In that apron a window 5 inches by 6 inches was cut. The roentgenologist, with the aid of a head screen held just above the patient's good leg or just below it, could then direct the surgeon in the manipulation of the slings supporting the fragment, or the traction. It was found necessary to fluoroscope only in the lateral projection.

To elaborate on the treatment: Certain precautions were found necessary. The pins were of the Steinmann type and varied in thickness according to the size of the individual bone and the amount of traction necessary. The lower pins had to extend 2 inches beyond the skin on either side of the leg, the upper pin about 3 inches and at times 4 inches. Atrophy of the thigh was often very rapid and very marked. Unless the pins were long enough they would slip into the cast when the patient moved. Compensation for the atrophy was obtained by the use of felt on the inner side of the thigh or by narrowing the plaster cast without removing it. This could be done by cutting away part of the inner side of the plaster above the lower pin and replacing it with fresh plaster closer to the skin, cutting wedges in the front and the back of the cast, then narrowing the spica, or removing the front of the cast.

All except one of the patients treated were injured by shell fragments (mostly from mortars, exploding land mines, or booby traps) or by rifle and machine-gun bullets. Many of them were in shock when they came aboard and were treated for this before definitive care could be given to the fractures. After these patients had been evacuated to a large base hospital, more specific methods of treatment, if found advisable, could be applied without having lost time, length of limb, or position. About 45 cases were treated in this way during the summer months of 1944, all of them being young Marines, soldiers, sailors, or prisoners of war.

The exception mentioned was the only patient with a simple fracture who sustained his injury from a fall aboard ship. He was one

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4. The patient who sustained this compound comminuted fracture was brought aboard in a single spica cast without pins. Some shortening was noticed. He was placed on the fracture table and the cast removed. The normal length of the limb was restored by traction and the pins inserted. The large wound was then cleaned and dressed. Notice the fairly good lateral alinement. Once the cast was applied incorporating the pins, position and length remained unchanged.

of the early cases treated in the manner described, by pinning, but without the use of the fluoroscope. This case showed the absolute need of fluoroscopy and demonstrated the ease with which the fragments could be lined up with its use. It also showed that even after 3 weeks of malposition, it was possible to pull the fragments apart, correct the alinement and replace the cast, the pins being adequately anchored in the cast (figs. 3 and 4).

SUMMARY

A relatively simple method for the early care of the fractured femur on a hospital ship in the forward areas which provides bone fixation, traction, and immobilization without the use of elaborate apparatus, permits moving the patient in his bunk, permits easy evacuation of the patient, and obviates the loss of apparatus, is described. It consists of a combination of the plaster of paris spica cast, incorporating in it a full Steinmann pin below the fracture site and a half pin (one going through the cortices of the femur but not through the inner side of the thigh) above the fracture. A protected fluoroscope is used to determine the position or the alignment of the fragments through a lateral view. This machine is run by an experienced

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roentgenologist. This method of treatment was utilized because it was found impossible to be adequately and constantly supplied with other forms of equipment that would leave the ship with the patient and could not be replaced in zones of activity too far from the source of supply. This method made evacuation of the patients safe, easy, and without fear of loss of alignment of the fragments or of length of the limb.

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BIOLOGIC INVESTIGATIONS ON PROACTINOMYCIN

As a result of the foregoing investigations it can be seen that proactinomycin possesses chemotherapeutic power in that when given to mice by mouth it can confer a considerable degree of protection against intraperitoneal infection with haemolytic streptococci. This effect takes on additional interest from the fact that even with a large dose it has not been possible to detect in the blood any antibacterial effect (using the staphylococcus, which is quite sensitive, as the test organism). Nevertheless, not only this large dose, but a dose one-eighth the size, had a chemotherapeutic effect.

Like other relatively innocuous antibiotics, such as penicillin and helvolic acid, proactinomycin is excreted in the urine and bile. It is absorbed from the alimentary canal. In sufficiently large doses it stimulates the vaso-motor centers and decreases the rate and force of the heart-beat in cats, and inhibits the contraction of the guinea pig uterus. Repeated injections cause fatty changes in the livers of mice.

The question naturally arises whether this substance can be of interest in the treatment of disease in man. It is undoubtedly much more toxic than penicillin or streptomycin (Robinson, Smith and Graessle, 1944 [1]), and where these can be made effective there would be no indication for the use of the more toxic substance. Nevertheless there is increasing evidence that resistance to penicillin can be acquired by certain organisms, particularly the staphylococcus, and this phenomenon may well be true of all chemotherapeutic agents. It is, therefore, well to take note of substances such as this, to which a penicillin-resistant staphylococcus is fully sensitive, which might, at any rate in local application, provide a possible alternative.

This work is also of interest in that it shows that yet another substance from the Actinomyces and Proactinomyces group of organisms has chemotherapeutic properties, though it is not comparable to the others, particularly streptomycin, in this respect.—FLORY, H. W.; JENNINGS, M. A.; and SANDERS, A. G.: Biological investigations on proactinomycin. British J. Exper. Path. 26: 337–349, October 1945.

[1] ROBINSON, H. J., SMITH, D. G., and GRAESSLE, O. E.: Chemotherapeutic properties of streptomycin. Proc. Soc. Exper. Biol. & Med. 57: 226–231, November 1944.

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AN EXPERIENCE WITH ATABRINE ABOARD A TROOP TRANSPORT

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When a troop transport is carrying personnel to a combat area, the number of patients in the sickbay must be reduced to a minimum. On one occasion, however, this purpose was almost defeated by a syndrome resulting from the prophylactic administration of quinacrine hydrochloride U. S. P. (atabrine dihydrochloride).

The atabrine regime for personnel in this particular incident was not initiated until the troops were aboard ship. Troop enlisted men and officers alike, under strict supervision, were given 0.05 gram of atabrine for 3 days immediately following the evening meal, and 0.1 gram daily thereafter. Since the drug was given to troop personnel only, no member of the ship's company received atabrine during that period.

There were no complaints until the eighth day of drug administration. On that and the following day, 13 patients were admitted to the sickbay for treatment and at least 6 men were treated as ambulatory patients. At least 6 others did not report to sickbay. The signs and symptoms of all patients were similar in nature but varied in degree. The prodromal symptoms consisted of anorexia, generalized cramping abdominal pain, nausea and/or vomiting which were followed in from 6 to 12 hours by diarrhea.

The diarrhea was explosive in onset and resulted in from 15 to 20 profuse, watery stools during the course of a few hours. A careful history elicited negative evidence for the presence of blood or pus in the stools. Occasionally, severe vomiting preceded or accompanied the diarrhea and naturally increased the abdominal discomfort. Those patients admitted to the sickbay had oral temperatures ranging from 99.8° to 102° F. They all showed evidence of dehydration and looked and complained of being acutely ill. A mild leukocytosis also was present.

A differential diagnosis between food poisoning and the untoward effect of atabrine was necessary. Although the bacteriological facili-

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ties were limited, eosin-methylene-blue media were inoculated with the stool specimens and in 24 hours following incubation at 37° C. several different samples revealed elevated, irregular, dark green and dark brown colonies. These colonies in turn were subcultured on Russell's double sugar and all showed a yellow slant and yellow butt with bubbles present in the butt indicating the fermentation of lactose with formations of acid and gas. *Escherichia coli* and/or *Aerobacter aerogenes* were probably the organisms involved.

Aside from the bacteriologic evidence, it must be noted that the ship's company and troops ate the same food, handled and served by the same cooks and attendants. A similar situation existed in the officers' wardroom and not one Navy man reported to the sickbay with gastro-intestinal symptoms.

Treatment of the bed patients consisted of temporarily discontinuing the atabrine, controlling the diarrhea and cramps with bismuth and paregoric, and hydrating the patients. Parenteral fluids were not necessary because all patients could retain frequent small quantities of fluid orally. Recovery occurred within 72 hours. Atabrine for ambulatory patients was not discontinued but the dose was reduced to 0.05 gram for 2 days and then raised to 0.1 gram. All of the ambulatory patients were returned to the full dose and showed no further reactions. The bed patients were again given 0.05 gram of atabrine as soon as vomiting, diarrhea, dehydration, and fever were controlled. Sixty percent (8) of these men were taking the full dose within 4 days and showed no further intolerance. The remaining 40 percent (5), however, returned to sick bay within 12 hours following the resumption of the 0.05 gram dose. The signs and symptoms were comparable to those present at the original admission and of the same severity. Dehydration was not as obvious since the men reported for treatment earlier.

Since debarkation was imminent it was decided to put these men on quinine prophylaxis and to consider them intolerant to atabrine. No further difficulty was apparent.

Two weeks following the initial dose of atabrine, an officer reported to sickbay with a full-blown generalized giant urticaria. His feet, hands, face, and penis were painful and edematous, and large wheals were prominent all over his body. After careful inquiry into his past history and present diet, it was decided that this was the result of atabrine sensitivity or toxicity. The drug was discontinued, symptomatic treatment was instituted, and he was on the sick list for 4 days. A provocative test was considered but the day of debarkation was too close, so quinine was substituted for atabrine.

It may be assumed that the heat and humidity of the tropical climate plus the motion of the ship exaggerated the syndrome as de-

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scribed. For this reason as well as for those already mentioned it is suggested that atabrine prophylaxis be initiated 3 weeks before troops embark.

SUMMARY

1. Gastro-intestinal symptoms which resulted from atabrine prophylaxis occurred about 1 week following the initial dose of 0.05 gm.

2. Of 826 officers and enlisted men given the drug, about 3 percent exhibited untoward reactions, but only 0.7 percent could not tolerate readministration of the drug. For these men, quinine instead of atabrine was provided.

3. One case of giant urticaria was attributed to atabrine.

4. It is suggested that atabrine prophylaxis be initiated 3 weeks before troops embark.

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EARLY OBSERVATION OF ANTIBIOTIC ACTION

In his book "Essays on the Floating-Matter of the Air" (1881), the physicist, John Tyndall, described experiments which he carried out in 1875 refuting the doctrine of spontaneous generation of life. In the course of these experiments tubes of organic infusions were infected with organisms after exposure to the atmosphere. A number of cases occurred when such tubes which were turbid and swarming with bacteria, became covered with Penicillium glaucum, three unspecified kinds being noticed. The bacteria in these tubes lost their translatory power and fell to the bottom, leaving the liquid between them and the superficial layer clear. Tyndall ascribed this to the success of the molds in the struggle for existence and notes that access of oxygen to the body of fluid must have been hindered. He did not, however, test the clear liquid for its capacity to support newly implanted bacterial life. It is interesting to speculate upon what the consequences might have been had Tyndall allowed himself to be drawn from his main investigation.—DAVIES, C. N.: Early observation of antibiotic action. Nature 156: 666, December 1, 1945.

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DENTAL PROBLEMS ON SUBMARINES[1]

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Dental services aboard a submarine tender are rendered primarily for the personnel of submarines tied up alongside, and secondarily for the relief crews and personnel of the tender. It is imperative that oral tissues of submariners be placed in good condition prior to extensive patrol periods in war areas. Toothache or tissue infection renders a man impotent as a fighting man when his time and his efficiency are vital factors in the success of a submarine attack.

Squadron instructions of the squadron to which the author is attached includes the following: "The dental officer is designated as an ex officio member of the squadron staff. He will arrange examinations in the dental chair for all officers and men of submarines assigned to the tender for refit. He will make necessary appointments to complete all work during the refit period." This has been the objective of the dental department of this squadron. A submarine war patrol made on the U. S. S. *Sea Fox* with the objective of viewing the dental situation under combat conditions reveals that in spite of frequent examination and treatment, crews present an alarming susceptibility to dental disease.

The diet seems adequate with the exception of minerals. Fresh milk is, of course, out of the question and powdered or canned milk is not palatable. Efforts have been made by dental officers on several tenders to effect a regular serving of iced, flavored, powdered milk supplemented by frequent servings of ice cream—this would seem a solution, in part at least, for supplying dental minerals. Wafered, flavored calcium salt tablets could be given. The value of such calcium administration is questioned by many dentists who claim the fully formed tooth is beyond therapeutic aid. It would seem reasonable to assume, however, that the deposition of secondary dentine would require at least a normal blood calcium.

Dental caries is rampant and can be laid to a diet very high in carbohydrates plus very poor oral hygiene. Most all submariners are heavy coffee drinkers and they drink it "black and sweet." These solutions resemble a coffee-flavored simple syrup. Cakes and pies are

[1] Received for publication May 1945.

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usually in evidence in the galley. There is lots of bread and jam, lots of potatoes and gravy—carbohydrates galore! Long patrols with necessitated abstinence from alcholoic beverage seem to create a desire for sweets. A continued carbohydrate diet of this type increases susceptibility to dental caries.

An effort is made on the tender to diagnose incipient carious areas through routine use of bite-wing x-rays. Men with apparently sound teeth will, after two or three patrols, evidence decay in proximal surfaces of bicuspids and molars that is difficult to find with the regular mouth mirror and explorer examination.

In the dental operating room, all teeth with carious exposed pulps are removed. Intermediate bases are inserted in most two-surface cavities prior to placing the alloy filling. An attempt is made to overcome fear of pain by the routine use of procaine hydrochloride, if the patient wants it. The teeth of many young submariners have large pulps which necessitate greater care by the dentist in cavity preparation. This age group shows many erupting third molars which cause grief on a patrol. These are extracted as soon as possible after examination to enable post-operative treatment and observation before the boat returns to a patrol area.

The actual patrol lasts from 6 to 8 weeks during which conditions are unfavorable for good oral hygiene. Water distilled aboard is adequate for drinking and cooking purposes, but is insufficient for frequent bathing and the shower room is secured most of the time unless a water reserve has been built up.

Dental hygiene is closely allied with bathing habits and, upon questioning, many of the men admit that their toothbrushes remain unused day after day. Although space is limited, facilities in the crew's washroom are adequate for tooth brushing at any time. Small, convenient, individual drawers are available there for toothbrush and shaving gear. The submariner just doesn't seem "tooth conscious" and considers brushing of the teeth too much trouble on a war patrol. Lack of good oral hygiene leads to loss of tissue tone. Resistance to oral infection is low and gingival recession is prevalent. One submarine captain, through his welfare fund, purchased all available dental floss and constructed an adequate dispensary to be placed in the control room for all hands. A page from a dental journal illustrating correct use of dental floss was secured to the bulkhead alongside. This captain had become alarmed at the large number of cavities developing in the teeth of his men, and wanted to do something about it. Similar interest by other submarine commanders would be beneficial.

Submarine personnel leaving liberty areas often face the danger of Vincent's infection. Pharmacist's mates confronted with this problem usually are acquainted principally with the use of sodium per-

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borate, and with the isolation and sterilization of mess gear of those infected. He does as well as possible with the training he has. Some have been dental technicians and are better prepared to handle emergencies and treatments they have followed through with the dental officer.

The following conclusions are submitted:

1. Actual work at the chair with a dental officer for at least a 10-day period should be a requisite for all pharmacist's mates being considered for submarine duty. They can then *see* how to treat dental emergencies, and become acquainted with dental medicine.

2. Elimination of patient's fear by routine administration of procaine hydrochloride.

3. Bite-wing x-rays at least once a year. These should be placed in the health record in a small glued-in envelope.

4. There should be better dental education for submarine personnel. This should definitely be made a part of general hygiene and first-aid instruction, and could be accomplished by pamphlets, slide pictures, or lectures. Dental problems can be lessened for submariners with a more definite and direct dental educational program during the refit period.

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COMPARATIVE EFFECT OF SULFONAMIDE AND PENICILLIN IN PNEUMONIA

A series of 126 patients over the age of 35 years suffering from pneumonia was divided by random selection into two groups, one of which was given sulfathiazole, the other penicillin. All patients received the same symptomatic treatment and general clinical control.

The distribution of factors known to influence the course of the disease was the same in the two groups.

Each method achieved fairly similar results. In three patients, however, it was thought that penicillin had produced an unexpected recovery.

There is no reason for abandoning properly controlled sulfonamide treatment for the average case; and it is suggested that penicillin should be used for selected patients, usually in combination with a sulfonamide. Indications for the use of penicillin are tentatively suggested.

The cause of delayed resolution is discussed.—ANDERSON, T. and FERGUSON, M. S.: Comparative effect of sulfonamide and penicillin in pneumonia. Lancet 2: 805–808, December 22, 1945.

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SHIGELLOSIS STUDIES

III. CLINICAL OBSERVATIONS ON DYSENTERY CAUSED BY *SHIGELLA FLEXNERI III*

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In mid-September 1945 there was an epidemic of bacillary dysentery among units of the Fifth Fleet in the Tokyo Bay area. Several major ships had large numbers of cases, and the disease was epidemic among the smaller units. Shore installations were peculiarly free from the disease. At the height of the epidemic there were 1,300 persons affected, but there were no reported fatalities in the entire series. One hundred patients with dysentery or unclassified diarrheal diseases were admitted to the U. S. S. *Benevolence*. These included many of the sickest persons in the area as well as some from smaller units without medical officers.

Sixty of the affected patients were studied by one of us and were considered on the basis of cultural or sigmoidoscopic evidence to be suffering from bacillary dysentery. Twenty cases yielded cultures positive for dysentery bacilli. The only strain isolated was *Shigella flexneri III*. (Some also agglutinated with *flexner VIII* serum.) The clinical features of these 60 cases constitute the basis for the following report. They represent the fully developed illness as observed in patients selected for transfer to a hospital ship. Many of the patients treated in sickbays were less seriously indisposed.

TYPE OF ONSET

In 78 percent of the cases the onset was acute, often initiated by a chill followed by fever of from 101° to 105° F., abdominal cramping, and after several hours, watery diarrhea. In 18 percent there was an atypical coryzal onset, with generalized muscular aches, cephalgia, rhinitis or sore throat, and injection or edema of the nasopharyngeal mucous membranes. In both the typically acute cases and those with coryzal onset, the initial chill and febrile response were diagnostically misleading, so that many of the cases

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could not be differentiated at the onset from acute catarrhal fever or virus pneumonia. In a number, the abdominal cramping, nausea and vomiting raised the question of appendicitis. In two instances exploratory laparotomies were performed. Of the entire series, 4 percent had an insidious onset in which abdominal cramping and diarrhea were the leading symptoms.

CLINICAL FINDINGS

Subsequent to the initial chill and fever, diarrhea developed in all the cases. During the most acute part of the early phase the majority of the patients reported watery bowel movements which occurred at 30 to 60 minute intervals. At this stage moderate abdominal cramping was the rule. Later the frequency of the movements became less, the abdominal cramping tended to give way to severe tenesmus, and the stools became grossly bloody. Prostration became more severe with each passing day so that many of the patients were listless and exhausted. Neither dullness of the sensorium nor delirium occurred. Tenesmus or proctospasm was a prominent feature in 52 percent of the cases, and resulted from induration, edema, and deep mural infection of the pelvic colon and rectum. Rectal spasm, and in some cases strangury, also resulted from this cause.

Although chills and fever, nausea and vomiting and diarrhea were outstanding symptoms in all of the cases, these symptoms were not unlike those of any other severe enteric infection.

On physical examination most of the patients had drawn facies which expressed their abdominal discomfort and desire to sit on the bedpan. A few had frank dehydration, but in the majority this had been forestalled by the intravenous administration of fluids. Evidence of nutritional disturbance was manifested in those who had been sick for several days by the obvious weight loss, glossitis, and in one instance, perianal dermatitis not due to excoriation. This group of late-comers was bony, cachectic in appearance, and comparable, in many ways, with prisoners of war who had become malnourished in detention camps (*1*).

In almost all there was definite abdominal tenderness, usually maximal over the course of the colon, particularly in the left lower quandrant of the abdomen and in the suprapubic region. In about one-third of the cases there was some muscular spasm in the abdominal wall. In some cases this was associated with distension, in others it was of a voluntary nature, and in almost all was more generalized than that seen with early appendicitis.

Two patients were operated upon for suspected appendicitis. In these, tenderness with muscle spasm was maximal over McBurney's point. In both of these the serosa of the appendix and the terminal

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ileum was injected. The appendix was edematous. Histologic examination showed leukocytic infiltration, mucosal edema, and beginning luminal occlusion. Six other patients were admitted for suspected appendicitis and were not subjected to operation. Thus eight, or 13 percent, of the cases were confused with acute appendicitis. The so-called "appendicular syndrome" in bacillary dysentery is recognized by authorities on the subject (*2*).

In a small percentage of cases there was injection of the nasopharyngeal mucous membranes or râles at the lung bases. The possible specific significance of these respiratory findings is discussed later.

STOOL FINDINGS

At the onset the stools were not typical. As already noted, there were many cases with a delay in the appearance of diarrhea. On the other hand, some cases started more abruptly with many watery evacuations. Eventually all of them had watery evacuations. Ninety percent showed blood, either as a streaking or as a passage of bright red material without feces. The stools soon lost their feculent character. Grossly none of the stools had a "currant jelly" appearance. Pus and mucus were not noteworthy in the gross specimens. In agreement with Hardy and Watt (*3*) we would conclude that the "characteristic dysentery stool" is not a requirement for the diagnosis of bacillary dysentery. Microscopically the stools showed a large amount of cellular exudate with a great number of macrophages. Ghost cells were not prominent. Charcot-Leyden crystals and protozoan parasites were not observed.

SIGMOIDOSCOPIC EXAMINATIONS

Fifty-six of the patients were studied sigmoidoscopically. All showed brilliant red injection of the mucous membrane. Marked edema was present in most instances. This was characteristically accompanied by spasm and rigidity of the bowel wall. In 68 percent there were areas of adherent fresh purulent exudate and in 84 percent either preulcerative hypertrophy and injection of lymphoid follicles or small ulcerations of the bowel wall. Large undermined confluent ulcers were not seen. Some of the cases observed late in the disease showed healing of ulcerations with adherent tenuous mucus and a dry, granular mucous membrane. Others showed a persistence of edema, hyperemia and spasm.

The sigmoidoscopic examinations were performed at various stages of the disease and in some instances several observations were made. The sigmoidoscopic picture may therefore be described as it varied with the course and severity of the dysentery.

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1. *Red follicularization with mild hyperemia and swelling of the surrounding mucous membrane.*—In this stage the exudate was mucoid and scanty. This picture was commonly seen early in mild nonulcerative cases. It was the result of inflammation and engorgement of miliary lymphoid follocles in the submucosa.

2. *Discrete, multiple, pinpoint- and pinhead-size ulcerations with diffuse edema, hyperemia, induration and spasm of the bowel wall.*—With this more acute picture the exudate was serous, sanguineous, and purulent. This picture represented necrosis of follicular areas with secondary infection and cellular reaction in the bowel wall from the dysentery toxin.

3. *Edematous and boggy mucous membrane with a cobblestone appearance in small areas.*—The exudate in this stage was mucoid, mucopurulent, and streaked with blood. The bowel wall was still indurated and spastic. This picture represented the stage of indolent repair.

Inflammatory polyps were seen in only two instances. This was an extension of the cobblestoning already noted and represented reactive hyperplasia of the mucous membrane.

CULTURES

Cultures were made in all cases. In most instances they were obtained by the rectal-swab technic and were plated directly on *salmonella-shigella* agar. Suspicious colonies were transplanted to Russell double sugar agar, and sub-cultures were made for individual fermentation tests. Cultures from 20 cases gave reactions characteristic of *Shigella.* Serologic studies established the strain as *Shigella flexneri III.* Nine of the cultures gave a secondary agglutination with *flexner VIII* serum.

MISCELLANEOUS OBSERVATIONS

Routine leukocyte counts were performed in 58 cases, the white blood count exceeding 10,000 in 40 percent of them. The incidence of clinical and laboratory findings in all the cases upon which observations were made is recorded in the accompanying table.

The clinical features were helpful in leading to the suspicion of bacillary dysentery but were not always a reliable index to the ultimate diagnosis. Great reliance was placed upon the sigmoidoscopic examination. Confirmation by stool culture was diagnostic when positive. The microscopic character of the stool exudate was a helpful aid. In the presence of the epidemic, all atypical febrile illnesses were considered as possible dysentery.

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COURSE OF THE DISEASE

The duration of the disease was variable and indefinite as indicated by the previous studies of Hardy and Watt (*3*). Most of the patients remained on the sick list for about 19 days. There were many who returned to duty at the end of a week and others who were still hospitalized after 6 weeks.

In general the first signs of improvement were the recovery of appetite and subjective strength. Following this the frequency of the stools and the severity of the tenesmus gradually subsided. Finally, signs of malnutrition or avitaminosis disappeared. The return of weight to normal was slow and uneven. There was no clear delineation between the acute disease and convalescence. Most of the patients probably required several months to regain full strength and normal weight. The possibility of chronic residual colitis is not as yet fully excluded.

The return trip to the United States afforded an opportunity to observe 40 patients who had recovered from the more acute stages of severe dysentery. As a group they were all suffering from degrees of malnutrition. The average weight loss had been 20 pounds. The patients were weak and unable to perform any strenuous physical labor. Their appetites had returned to normal but after eating a full bland meal there was an inclination to early bowel evacuation. Coarse foods were not well tolerated.

The most prevalent and immediate complications of bacillary dysentery are dehydration, acidosis, anemia, and malnutrition. These were reduced to a minimum by the free use of supportive therapy. Malnutrition required the most energetic treatment and was the most difficult to forestall. Less common complications included conjunctivitis,

Symptoms and findings in cases of dysentery studied

	Percent positive		Percent positive
Onset:		Signs—Continued.	
Typical acute	78	Injected mucous membranes	15
Typical insidious	4	Dehydration	10
Atypical coryzal	18	Stools:	
Symptoms:		Watery	100
Fever over 100° F	95	Sanguineous	90
Fever over 103° F	37	Sigmoidoscopic findings:	
Chills	95	Edema	77
Nausea or vomiting	65	Exudate	68
Abdominal pain	98	Ulcers	62
Tenesmus	52	Spasm	48
Diarrhea	100	Red follicles	29
Signs:		Ulcers or follicles	84
Abdominal tenderness	97	Culture for *Shigella flexneri III*	38
Muscle spasm	32	White blood count over 10,000	40
Râles in chest	17		

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herpes labialis, arthritis, laryngitis, and other late respiratory symptoms. Conjunctivitis, characterized by both ciliary and conjunctival injection without discharge was noted in three instances. Prominent herpes labialis was noted in four patients. The late respiratory symptoms were variable and included nasal obstruction, edema or injection of the nasopharynx, laryngitis, and transitory râles at the lung bases. Associated with these objective respiratory signs were all the subjective symptoms of an acute rhinitis, tracheitis, or bronchitis.

Three of the cases had arthritis as a complication. In two of them there was involvement of only one joint, in one the hip and in the other the knee. In the third case there was a migrating polyarthritis. There was fusiform swelling of the phalanges of the hands, and there was pain, tenderness and limitation of motion in joints of the fingers. shoulders, and knees. The sedimentation rate remained between 20 and 30 millimeters (Cutler) in this case and the electrocardiogram showed flat T waves in Leads I and II. The P–R interval was normal. There was no objective clinical evidence of carditis, but this patient was kept at strict bed rest and showed improvement on large doses of salicylates.

THERAPEUTIC MANAGEMENT

Experience with a previous outbreak of dysentery revealed the sulfonamide resistance of this strain of *Shigella*. (*4*). In that series positive stool cultures were obtained from 24 of 35 sulfonamide-treated cases 10 to 14 days after onset. Sulfadiazine had been used in adequate dosages. For this reason sulfonamide therapy was not instituted as a routine measure on this ship. It was given to a small number of patients in whom it failed to alter the temperature curve or favorably affect the symptoms.

The basis of supportive therapy was the maintenance of protein and electrolyte balance and the insuring of as much rest as possible for the affected bowel. An initial clear-liquid diet including cereal gruels but no milk was supplemented by intravenous saline, dextrose, plasma, and whole blood. The red blood count, plasma specific gravity (total protein), urinary output, and the appearance of the tissues served as guides in determining the quantities of these substances which were employed.

Diarrhea, abdominal cramps, and tenesmus were treated with bismuth subcarbonate, tincture of opium, and heat to the abdomen. A suspension of bismuth subcarbonate prepared according to the following formula devised by S. W. Richardson, chief pharmacist's mate, U. S. N. was found to be highly satisfactory:

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℞	*Gm. or cc.*
Corn starch	37.000
Simple syrup	370.000
Bismuth subcarbonate	130.000
Essence of peppermint	1.000
Water (to make)	1,000.000

Mix the starch in 50 cc. cold water to form a smooth paste. Heat the simple syrup and 250 cc. of water to boiling, then quickly add the starch mixture and continue to heat for 15 minutes. Mix the bismuth with 125 cc. of water to form a smooth paste. Strain mixture of cooked starch through crinoline and add bismuth mixture. Mix. Add peppermint and sufficient water to make 1,000 cc.

This preparation was administered orally in doses of 30 cubic centimeters every 4 hours day and night. Two hours after each dose of bismuth 0.7 cubic centimeters of deodorated tincture of opium was given. In some cases with severe tenesmus the following mixture of scopolamine and belladonna was effective in relieving spasm:

℞	*Gm. or cc.*
Scopolamine hydrobromide	0.006
Tincture of belladonna	15.000
Aromatic elixir (to make)	120.000

Directions: One teaspoonful every 3 hours.

Lavage of the rectum with small quantities of warm physiologic saline solution seemed to hasten the recovery and reduce residual proctospasm in cases that had passed through the acute diarrheal stage of the disease. Retention enemata of aluminum hydroxide solution were less satisfactory.

Very few cases were seen early enough to note the effects of early saline purgation. Three were so treated because they were seen within 8 hours of onset, and spontaneous diarrhea had not yet commenced. All three had a less severe and less protracted course than the cases treated by the other methods.

SANITARY MANAGEMENT

The resistance of *Shigella flexneri III* to available sulfonamides and the persistence of positive stool cultures (*1*) indicated that abortive missed cases, carriers, and convalescent individuals were the most important sources of infection, particularly when such persons were permitted to handle foods. Watt and Hardy (*5*), in a survey of the normal population, found 380 positive cultures. Only two of these were taken from subjects who had been under the care of a physician. It is likely, therefore, that a large number of asymptomatic carriers were present on the ships in the Tokyo Bay area. This probability is borne out by epidemiologic studies conducted on some of the vessels.

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In Tokyo Bay there was a great variation in the case rates of the different ships present. Such a variation would result from hand-to-mouth infections, and the highest incidence of dysentery would be expected on vessels with the maximum number of opportunities for food contamination. There was almost no disease at neighboring shore stations where flies were prevalent. Adequate chlorination and repeated bacteriological examination of the drinking water ruled out that source of infection.

During hospitalization aboard this hospital ship all cases were strictly isolated by the compartmentation technic (*6*). Individual gowns were used. The hands of the attendants and medical officers were washed and dipped in cresol solution after each contact. Dishes were boiled. Bedpans were sterilized by steam. Cresol solution was poured on the excrement and allowed to remain in contact for a short time before disposal. All linen was separately autoclaved before being washed by the ship's laundry.

With few exceptions all patients were isolated until the stool cultures became negative. The occasional patient discharged before this could be done was given detailed instructions in personal cleanliness, including the use of the nail brush. In each health record was entered the recommendation that the individual should avoid handling food for 6 weeks and until a rectal-swab culture was negative.

All messmen and steward's mates aboard this ship were examined at weekly intervals for cleanliness and specifically questioned for evidence of abdominal cramps or diarrhea. Rectal-swab cultures were made on all personnel reporting at sick call with lower bowel discomfort or diarrhea. All such persons were assigned to duties removed from food handling.

DISCUSSION

The catarrhal reaction of the respiratory passages, the "grippe"-like onset, and the occasional appearance of herpes raise the question whether a virus may have been associated with the organism as a contributory or predisposing etiological agent. In other words, the *Shigella* organism may have been closely associated with a virus either in symbiosis or as a secondary invader much as the *Hemophilus influenzae* is known to have been long associated with influenza virus. Dysentery caused by *Shigella sonnei* is frequently ushered in by respiratory symptoms. Moreover, both types of dysentery have been shown to be resistant to therapy with sulfadiazine which is effective against most other *Shigellas* (*1*) (*7*). Virus studies would have been invaluable but could not be carried out under existing circumstances.

Although it was our opinion that the dysentery was sulfonamide resistant some medical officers in outlying ships claimed results with

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sulfonamide medication. This hospital ship saw the failures and in many cases the most severe dysenteries. Our results with sulfadiazine, which was the only sulfonamide available, were poor, although no controlled studies were attempted. Almost all of the cases admitted to our ship for prolonged convalescence from severe, protracted dysentery had had sulfonamide therapy in the early stages of the disease without marked relief or alteration of symptoms.

Most observers agreed that the disease was spread by food handlers, flies, and food. Food handlers who were convalescent from an attack of unexplained diarrhea or who were asymptomatic carriers represented an important source of contagion. Water had been carefully treated and, when tested, was free of pathogens. The units which were most successful in controlling the spread of the disease were those which immediately instituted inspection of all messmen and supervised scrubbing of the hands before preparation of food. Fly control was considered important even though there was little dysentery ashore where flies were more plentiful. Measures of this type were adopted by all ships in the area and contributed to a limitation of the epidemic. One ship organized sanitary teams which supervised every phase of sanitation. Thorough scrubbing of the hands after defecating, before eating, and before handling food was supervised and timed by a member of the team. Handrails were scrubbed to prevent contamination by presumably disease-laden sea water. Deck washing with contaminated sea water was prohibited. Flies were kept at a minimum. A graph of daily admissions was drawn and showed a decline in admissions following the institution of this rigid control.

Felsen (8) has shown that chronic ulcerative colitis and distal ileitis follow shigellosis in some cases. Complications such as diffuse ulcerative colitis, segmental colitis, and granulomata of the small intestine were not seen in these cases. The observation period was too short to rule out such sequelae. It is possible that some cases may lead eventually to chronic intestinal pathology. The pathological mutations of this disease, its physical wasting and tissue necrosis, could be the basis for more remote complications. The etiology of intestinal granulomata and chronic bowel ulceration is not explained by the designation "idiopathic." On the other hand, chronic ulceration and mural fibrosis could represent the continuation of or the reaction to the pathological process observed by us in its acute phase.

The place of an enteric pathogen in the etiology of chronic intestinal pathosis can only be determined by a long follow-up study of such cases as these. The study of a large number of cases of recovered dysentery incurred in the Pacific area should be possible by reference to NavMed form F cards. Such an investigation could be undertaken at the end of a five-year period and would afford an opportunity to look for the answer to the etiology of some obscure intestinal states.

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CONCLUSION

1. An outbreak of dysentery caused by *Shigella flexneri III* is reported.

2. Dysentery caused by *Shigell flexneri III* is frequently characterized by an atypical respiratory onset and a slow stage of recovery. No mortality has been encountered.

3. The contamination of food by food handlers or flies is the most important source of contagion.

4. The organism shows resistance to sulfadiazine medication. In vitro tests with other sulfonamides are indicated.

5. This type of bacillary dysentery may bear an important relationship to late intestinal pathosis and future study of this possibility is indicated.

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CLINICAL NOTES

TRIVIAL SYMPTOMS FOLLOWING EXTENSIVE SKULL FRACTURE

REPORT OF A CASE

IRWIN PERLMUTTER
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Comparatively trivial blows to the head are frequently the cause of disproportionately severe brain injury. The converse; that is, a blow sufficient to fracture the facial bones and the base of the skull with no apparent brain damage occurred in the following case.

Case report.—The patient, an aviation ordnanceman, second class, 19 years of age, jumped from a speeding train at about 2030 on 21 February 1945.

On examination at a local hospital he was found to be alternately quiet and stuporous, and then violent, threshing about and shouting unintelligibly. He was bleeding from both ears, the nose and the mouth. There were hematomas of both periorbitas, marked deformity with obvious fractures of the nasal bones, mandible, and maxilla, which could be moved independently of the skull. There was a through-and-through laceration of the lower lip. The neck was not stiff, and except for an abrasion over the right sternoclavicular joint, no other injuries were apparent.

Neurologic examination findings were otherwise negative except that the right pupil was very slightly larger than the left, although both reacted equally to light. Vital signs were normal. The blood Bogen's test was 1.5 milligrams per cubic centimeter and a definite alcoholic odor was noted on the breath.

At about 2200 bleeding had practically ceased, and the patient lay quietly on his right side, assuming the fetal position. He responded with purposeful movements to noxious stimuli. Treatment that night consisted of prophylactic penicillin intramuscularly and careful observation for signs of increasing intracranial pressure.

By 0800 he was alert, oriented, and taking fluids by mouth. Neurologic findings were negative. He was transferred to this activity and the laceration of the lower lip was sutured.

On the following day the spinal fluid was found to be crystal clear and at a pressure of 162 millimeter of mercury. Cell count showed 52 erythrocytes and 3 leukocytes. There was no increase in protein, the Kahn reaction was negative, and colloidal gold curve normal. X-ray examinations demonstrated numerous skull fractures, including one at the left base just posterior to the mastoid process, and bilateral maxillary and mandibular fractures, one on the right in the region of the incisors and one of the coronoid process of the left ramus with associated fracture of the head of the ramus on the left. There was a

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fracture of the head of the ramus on the right side, and several fractures of the nasal bones with displacement.

By 23 February, 2 days after admission, the patient was alert, oriented, sat up, and his chief complaint was his inability to chew because of mechanical difficulties. His parents visited him about 1 week after the accident and noted no personality changes. His hospital course was completely uneventful. He was up and about after the third hospital day. The laceration of the lower lip healed per primam. The maxillofacial surgeons encountered no difficulty in achieving a good result by the use of a head cast with traction through both cheeks to wired teeth.

This case is presented as unusual because of the severity and multiplicity of the fractures of the bones of the skull and the lack of clinical signs of organic or functional cerebral damage. The facial bones acted as "shock absorbers," and although there was sufficient force to fracture the base, the cranial contents, according to all available evidence, remained apparently unharmed.

OPHTHALMIC DISEASE TREATED WITH PENICILLIN

REPORT OF TWO CASES

ARNOLD F. SAMMIS, JR.
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Penicillin has been used successfully in certain cases which were refractory to other agents. Iridocyclitis has responded to intramuscular penicillin after failing to respond to mydriatics and typhoid vaccine, Harner and Smith (*1*). Orbital cellulitis, refractory to sulfonamide therapy, cleared after large intravenous dosage with pencillin, Sloane (*2*). Keyes (*3*) stresses the use of penicillin in gonorrheal ophthalmia and in streptococcic and sensitive staphylococcic infections. Cases of ulcerative keratitis, keratitis dendritica, chronic blepharoconjunctivitis, orbital cellulitis and posttraumatic iridocyclitis are cited by Keyes, as benefited by penicillin. Its use in certain intra-ocular operations and in injuries is recommended. Despite low aqueous concentrations following parenteral injection, Town and Young (*4*) have demonstrated effective control of experimental infections of the anterior chamber using intramuscular injection. Successful management of posttraumatic hypopyon in a 78-year-old man was described by Sanders (*5*), in which large doses of sulfonamide

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and penicillin were needed together for a period of 4 to 5 weeks. Sievers, Knott and Soloway (*6*) describe 6 of 8 cases of gonorrheal ophthalmia neonatorum which responded to intramuscular penicillin in 24 hours. McNair (*7*) cited 2 cases of gonorrheal ophthalmia in adults treated with penicillin, who presumably had acquired their infection from venereal cases on board ship. One was unsuccessful but the penicillin was not available for 1 week, until a base hospital was reached. Town (*8*) describes a successful adult case cured by penicillin. Seelig (*9*) mentions an instance of gonorrheal ophthalmia treated with intramuscular penicillin and sulfonamide which progressed to corneal ulceration. Subconjunctival injection and topical instillation with local attention to the ulcers, brought complete relief.

A record of ophthalmic diseases treated with penicillin at the U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md., from 12 April 1943 to 1 September 1944, compiled by Craig et al. (*10*), showed seven successful cases out of nine of iridocyclitis and iritis, two failures with choroiditis, two successes out of two with corneal ulcer and one success (only one case) with purulent conjuctivitis.

Distribution of the drug is described by Struble and Bellows (*11*). Experiments on tissues of the rabbit eye showed the highest concentration from a single massive intramuscular dose to exist in the extraocular muscles, then the sclera, conjunctiva, blood, choroidoretinal layer, and aqueous humor. When approximate clinical dosage was used the ocular fluids and tissues were nearly free from penicillin. Large topical doses showed strong concentrations in the conjunctiva, sclera and less in the cornea, iris and aqueous. Maximal concentrations after subconjunctival injection were reached in the conjunctiva and sclera. Only minimal concentrations of the drug appeared in tears after parenteral injection. *In vitro* experiments mentioned by Keyes demonstrated the stability of penicillin saline solutions at room temperature for 21 days and of an ointment for 1 month, while under refrigeration the ointment's potency may remain 6 months. However, he replaced room temperature solutions every 48 hours. A report from the U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md. (*12*) stressed the need for the ointment to remain in contact with tissues for from 6 to 8 hours. The successful use of the ointment in eye infections was also cited by Crawford and King (*13*). That the usual ophthalmic preparations have little affect on the activity of penicillin, with the exception of adrenalin, was demonstrated by Cowan (*14*).

CASE REPORTS

Case 1. (*Gonorrheal ophthalmia*).—On 17 February 1945 this patient, a seaman, second class, was received from the Port Director's ship complaining of pain,

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redness, and a purulent discharge from the right eye of 8 hours' duration. There was edema and hyperemia of the conjunctiva and yellow matter covering the lid edges. Smear of this material showed many pus cells of which a considerable number contained groups of gram-negative diplococci resembling *N. gonorrhoeae*. Treatment was begun with sodium penicillin in 4 intramuscular doses of 20,000 units, and 2 drops of 1,000 units per centimeter in the right eye every hour for 2½ days. Four more injections were then given and the eye drops continued through 21 February 1945. On the second day a smear showed a few cells but no organisms. There was no pain in the eye. On 21 February 1945 the eye was entirely clear and he was discharged on 24 February 1945.

This patient had no venereal disease and inspection of the crew of his ship and the medical records revealed no cases of this or other eye diseases. However, the fact that a group of men had just previously returned to the United States and that this ship served many transients, may explain the absence of a contact case.

Case 2 (*Chronic recurrent conjunctivitis*).—On 4 February 1945 this patient, a torpedoman, second class, was admitted complaining of pain, itching, redness of the eye, and a watery discharge. He had suffered from intermittent attacks of this disorder since September 1944 and in December was on the sick list for 25 days. Several ophthalmological preparations were used and a consultation held. He improved but after return to duty several flare-ups necessitated topical treatment. On the present admission there were some tiny gray spots of corneal infiltration, and the disease had become more resistant to treatment. In addition a smear of the discharge showed gram-positive rod and cocci forms with a few pus cells. On 4 February, 1945 treatment with calcium penicillin was begun. Four intramuscular injections of 20,000 units were given and 2 drops of 500 units per centimeter solution placed in each eye every hour daily. A smear on 8 February 1945 showed gram-positive organisms but no cells. The course of injections and eye drops was repeated on 10 February 1945. A small amount of ointment (250 units per gram) was used terminally and on 16 February 1945 the eyes were clear and he was returned to duty.

These two cases of eye infection were encountered in the Western Pacific area. One case of gonorrheal ophthalmia responded rapidly to penicillin, and 1 case of stubborn conjunctivitis, in which the organism remained unidentified, healed more slowly. A follow-up of each case after 3 months revealed no sign of disease.

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HOOKWORM DISEASE IN INFANTS[1]

REPORT OF TWO FATAL CASES

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Commander (MC) U. S. N. R.
and
RALPH F. ALLEN
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Hookworm disease is highly endemic in many areas of the tropics and subtropics. The disease is contracted from direct exposure of the bare skin, such as that of the feet, to soil previously contaminated by human feces, and soon thereafter containing the infective stage (filariaform) hookworm larvae.

According to Scott (*1*), the incidence of hookworm disease increases with age up to 15 to 19 years of age. There is a gradual decline in the incidence of this malady as adulthood is reached. Strong (*2*) states that the incidence in pre-school children is about one-half that found in the school age group. The disease is rare in infants less than 1 year of age. This can be partially explained by the fact that infants do not come in contact with the infected soil.

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Two unusual cases were seen in the native hospital on Guam during December 1944 and January 1945. These cases were both infants less than 6 months of age with massive infestation of *Ancylostoma duodenale.*

CASE REPORTS

Case 1.—A. Chamorro male, age 3 months, was brought to the hospital in the early morning of 19 January 1945. The child was moribund on admission to the hospital. The following history was given by the infant's mother: The child had appeared to be in good health, except for extreme palor, until 1 day before admission to the hospital. About 6 or 8 hours before admission, he suddenly became short of breath and restless. He was taken to the Marine dispensary where the medical officer found the child to be "gasping, dehydrated, and extremely anemic." Fluids were given subcutaneously and the patient was transferred to the Civilian Hospital.

Upon admission to this hospital the child was found to be *in extremis.* He was gasping at irregular intervals, no pulse was palpable, the skin was cold and clammy, and the mucous membranes pale. Rectal temperature was 95.8° F. He was malnourished. There was protuberance of the abdomen. There were no other positive findings.

Treatment consisted of oxygen inhalations, transfusion of 180 cc. whole blood, and 1,000 cc. of 5 percent dextrose solution during the next 8 hours. The infant expired 10 hours after admission.

An autopsy performed shortly after death showed a male infant with waxlike skin and extremely pale mucous membrane. There was about 100 cc. of clear straw-colored fluid in each chest cavity and 60 cc. of similar fluid in the abdominal cavity. The organs were generally pale, and the retroperitoneal tissues were edematous. On section the lungs were congested at the bases. On opening the small intestine, numerous living hook-worms were seen. Some were free in the lumen, while others were attached to the mucosa. These worms were later identified as *Ancylostoma duodenale.* It is estimated that from 300 to 400 adult *Ancylostoma duodenale* were present within the small bowel. The mucosa was studded with many irregular hemorrhagic areas, and a moderate amount of dark blood was present in the lumen.

Case 2.—A Chamorro female, age 5 months, was brought to the hospital on 17 December 1944. The infant was dead on arrival. The following history was obtained from the patient's mother: Approximately 10 days prior to the child's death, she had passed frequent "tarry" stools, and appeared to be restless and irritable. Five days after the onset of the above complaints, the patient began having a productive cough, listlessness, and a constant fever. Shortly before death, dyspnea and palor developed.

The child was examined by a physician at one of the dispensaries several hours before death. His findings were recorded as follows: "Temperature 99.6° F. (axillary), pulse 155, respiration 62. The baby is normally developed, but shows marked palor of all mucous membranes. The lungs are resonant throughout, but the breath sounds are suppressed at the right base posteriorly. No râles are heard. Heart normal except for rapid rate. Abdomen protuberant and tympanitic. The remainder of the examination is normal."

An autopsy performed shortly after death showed an extremely anemic, but well nourished Chamorro female baby. All mucous membranes were blanched. The skin was waxlike in appearance, and there were numerous areas of depig-

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mentation of the skin in the pubic region. Lungs on section showed areas of consolidation of the right lower lobe. The heart, liver, and spleen were pale, but otherwise normal. The large intestine was filled with black liquid stool. The small intestine contained large quantities of bright red blood mixed with mucus. The mucosa of the ileum showed many hemorrhagic areas. Several hundred hookworms were attached to the mucosa, and many more of the parasites were free in the lumen. These parasites were identified as *Ancylostoma duodenale*.

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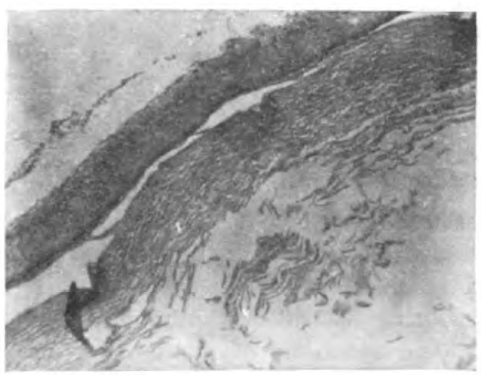


TREATMENT OF INFECTED SEBACEOUS CYSTS

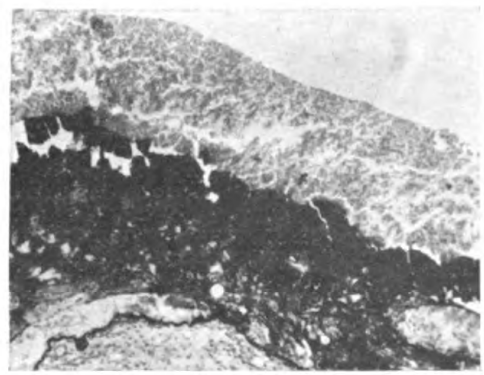
JACK FISHMAN
Lieutenant Commander (MC), U. S. N. R.

In naval dispensaries many patients come in complaining of sebaceous cysts, usually infected ones, and frequently located about the ears. Often they give a history of previous incisions or spontaneous drainage of these cysts with recurrences.

Complete removal of the cyst wall is necessary to avoid recurrences. This, however, is often extremely difficult in these infected sebaceous cysts as well as time consuming. Another method, therefore, was em ployed in one of our clinics in 512 cases and found to be highly satisfactory.



1. Microscopic section of sebaceous cyst, demonstrating the cyst wall formed by a layer of stratified epithelium. The cyst contents are keratinized epithelial cells.



2. Microscopic section of infected sebaceous cyst after treatment, demonstrating the silver nitrate staining the intact cyst wall, which is surrounded by inflammatory tissue.

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METHOD USED

1. The skin over the cyst is cleansed with Tr. of Merthiolate or other skin antiseptic.
2. With a sharp-pointed small sterile scalpel, a stab is made into the cyst.
3. The contents of the cyst are evacuated.
4. A small solid piece of silver nitrate, approximately 0.1 gram, is placed into the cyst cavity through the stab wound and a sterile dressing or band-aid is applied.
5. In about 24 hours the cyst wall is discolored by the silver nitrate, easily recognized, and loosened from the surrounding tissue. It is grasped with a hand forceps and easily removed *en masse*.
6. The cavity is then allowed to heal by granulation.

ADVANTAGES OF THIS METHOD

1. No recurrences or ill-effects were noted in 512 cases observed over a period of 1 year.
2. No anesthesia is necessary.
3. This method is simple and required little equipment or time.
4. This treatment was also found to be successful when employed in the noninfected type of sebaceous cysts.

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STUDIES ON SPECIFICITY OF INTRADERMAL TESTS IN DIAGNOSIS OF FILARIASIS

While it has not been possible for us to perform experiments which would yield direct evidence on the question of infective larvae of nonhuman filarial worms producing filarial sensitization in man, our results clearly show that extracts of these parasites are markedly antigenic when injected into mammalian skin, and that the resulting immune response is demonstrable by skin tests employing either specific or nonspecific filarial antigens.

We are, therefore, justified in supposing (a) that nonhuman filarial worms can influence the serologic reactions of man, and (b) that many of the hitherto unexplained false-positive skin reactions following the use of *Dirofilaria immitis* antigen are due to immune responses produced by filarrid larvae of animals. The matter should receive thorough field investigation—AUGUSTINE, D. L. and LHERISSON, C.: Studies on specificity of intradermal tests in diagnosis of filariasis. American J. Hyg. **43: 38–40, January 1946.**

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MEDICAL AND SURGICAL DEVICES

A HEAVY-DUTY, HIGH-CAPACITY, PORTABLE SUCTION PUMP FOR SURGICAL USE

H. MERRILL SHAW
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The automatic, tankless, electric air compressor supplied under Stock No. 6–090, Medical Department Supply Catalog used as a light, portable, surgical suction pump was found to be unsatisfactory when required for a heavy load of more or less continuous running.

The pump was constructed aboard the U. S. S. *Logan* to meet the need for a heavy-duty suction pump that could be used in the surgery, ward, or collecting station, or lowered into a casualty-carrying small boat if the occasion demanded. The device consists of an electric-fan motor, 1/16 horse-power, 1,100 r. p. m., 115 volts D. C., coupled through a spring universal joint to the shaft of a Gray Diesel engine fuel pump (General Motors Part No. 5230031 for Gray Marine Engine). The intake side of the pump is connected by 1/4-inch copper tubing to a sealed, large, wide-mouth bottle, which is in turn hooked up with a second bottle to provide a trap for spillover in the system.

Mounted on a light wooden platform and equipped with handles this pump was rugged and readily portable. With a long extension cord it was operated in an LCVP alongside the ship when it was impractical to bring the casualty aboard at once.

The apparatus can be assembled aboard ship from salvaged or spare parts. It was hooked up with a foot switch so that it could be started and stopped by the surgeon at will and also was wired to be operated from a hand switch.

This electrically operated pump had sufficient power to handle all the suction load required to meet our needs, without over-heating or failing to give sufficient suction force.

A similar pump was made for use on the beaches, by substituting a 6-volt D. C. electric motor, permitting direct operation from a storage battery on shore or in a boat.

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EDITORIALS

PREVENTION OF ACCIDENTAL POISONING

Accidental poisoning in the home where poisonous drugs are left within the reach of children or are carelessly taken or administered by members of the family is not an uncommon occurrence and the emergency receiving room of all hospitals is familiar with too many such cases. It is also true that in pharmacies and hospitals errors in the dispensing or administration of drugs unfortunately occur. Many measures are employed to heighten precautions and prevent such incidents. One of these is a card, the wording of which follows, and which is displayed over the dispensing counter in a pharmacy, in the dressing room of the ward, and on the doors of medicine cabinets in wards, is a constant remainder to nurses and Hospital Corps personnel.

BE CAREFUL WHEN DISPENSING DRUGS TO SEE THAT THE RIGHT DRUG IN THE CORRECT AMOUNT IS ISSUED. IN USING SOLUTIONS FOR THE EYE, EAR, NOSE, THROAT, URETHRA, RECTUM, OR ANY BODY OPENING BE SURE THAT THE PROPER STRENGTH IS EMPLOYED AND THAT THE TEMPERATURE OF THE SOLUTION IS APPROPRIATE. PARTICULAR CAUTION SHOULD BE TAKEN WITH EYE DROPS BOTH AS TO THE SOLUTION USED AND THE STRENGTH AND THE TEMPERATURE AT WHICH IT IS EMPLOYED.

It will be noted that the card warns about an important thing often forgotten, namely the percentage of strength, and also the temperature of solutions which are used for irrigation. Display of such a card has another merit in case an accident does occur. In event of investigation, it indicates that the question of accidental poisoning has not been neglected nor disregarded but that it has been thought of and the card represents one effort to prevent injury to patients.



PSYCHIATRY AND THE PROBLEM OF HOMOSEXUALITY

There has been, and still is, much difference of opinion in regard to the manner in which homosexual problems should be dealt with in the armed forces.

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Some would excuse all offenders and give them unsuitability discharges on the ground that homosexuality is a pathological condition and the individual should be regarded as mentally ill. Others, on the other hand, would mete out punishment out of all proportion to the offense, simply because the individual is homosexual.

There should be some middle meeting ground in the solution of these problems. There are factors on both sides which should be given careful consideration, and each case should be judged on its individual merits. If those who would be responsible for the handling of these cases have a clear understanding of the over-all psychological problems involved, the solutions would become simpler and equity and justice will be more nearly approached, both for the service and for the individual.

The sexual drive is one of the most powerful known to the human race. The race-preservation instinct is on a parity with the self-preservation instinct. Both are fundamental drives, which, if thwarted in one direction, will seek expression in another.

Homosexuality, in whatever degree, is an integral part of the individual's personality make-up. In the development of personality characteristics, how much weight can be attributed to inherent forces and how much to environmental influence cannot be determined. Over these developmental influences, the individual has no control; on the contrary, his later behavior is largely governed by them.

When the sexual drive in an individual becomes distorted by some developmental influence and deviates from the normal direction with such force that it becomes difficult or even impossible for him to direct it back into normal channels, it obviously becomes a pathological condition. When this state of affairs is present, the individual cannot change his feelings, and he has no control over the fact that he derives more satisfaction from homosexual relationships than he does from heterosexual ones. It is something which is simply beyond his will. Barring actual mental illness, however, he is a responsible member of society and as such he is fully aware of its taboos as well as of its accepted codes of conduct.

Neither the homosexual nor the heterosexual individual should be permitted to transgress the rights of others. Promiscuous sexual acts cannot be condoned or tolerated on miliary reservations, in barracks, on board ship, etc., whether they be homosexual or heterosexual. Such behavior, if permitted, is destructive to all military order, discipline and morale to the point of actually impairing the efficiency of any military organization.

All sexual acts should be punished in direct proportion to the seriousness of the offense itself, considering the circumstances leading up to and surrounding its commitment, as well as the location where

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it was perpetrated, and the individual should not be penalized solely for the reason that he may be a homosexual. That is a personality trait beyond his power to change.

Because of the natural feeling in regard to the subject, one is very likely to become unconsciously overly severe in meting out punishment in these cases.

Both the homosexual and the heterosexual must learn to control or properly sublimate his sexual drive and not transgress the rights of others. The homosexual in the military service is at a distinct disadvantage, because he is living in an environment which is continually stimulating to his sexual impulse. For this reason, known homosexuals are undesirable in the service and should be discharged before getting into difficulties. Those who have already committed offenses should be duly punished for failure of control, rather than for the direction in which their sexual drive manifested itself.

THE FREQUENCY OF TWINS AND MULTIPLE BIRTHS

The subject of multiple births is of universal interest and the recent birthday (May 28) of the Dionne quintuplets, who are now 12 years of age, has again directed attention to the phenomenon of multiple pregnancy. The United States Bureau of the Census has published reports on births in the United States and Canada for more than 30 years and the Metropolitan Life Insurance Co., in a statistical bulletin issued early this year, gave a summary of the single and multiple births in the United States and Canada for a 5-year period, 1939–43 inclusive. These sources contain a large amount of factual data of interest to all medical men.

The figures given show the total number of confinements in the United States during that period as 13,119,508 and in Canada 1,304,089. There were 140,003 and 14,511 twins born respectively in the 2 countries. In the United States, there were 1,441 triplets and 23 quadruplets and in Canada 140 triplets and no quadruplets.

It was in 1895 that Hellin stated his mathematical formula for computing the prevalence of multiple births. With a basic ratio of twins as one in 80 confinements, triplets occur once in 80^2 or once in 6,400 births and quadruplets once in 80^3 or once in 512,000 births. Using the same formula and raising 80 to the fourth power, quintuplets would occur once in 40,960,000 births.

It is interesting to compare the actual figures in the United States and Canada as shown by the Bureau of the Census with the results

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computed by Hellin's formula. The actual figures show twins occur in the United States once in 94 births and in Canada, once in 90. Triplets in the United States were one in 9,090 births and in Canada, once in 12,500. The quadruplet rate in the United States was 2 per million. This latter figure is almost exactly that of the Hellin formula. For twins and triplets, however, his figure is too low, 80 as compared to 94 for twins and 6,400 as compared to slightly more than 9,000 for triplets among births in the United States. The statistics indicated that race is of importance in the habit of twinning. There is a relatively higher incidence of multiple births among Negro mothers in the United States. It was 25 percent greater for twins, 75 percent greater for triplets, and 700 percent greater for quadruplets among Negroes.

These extensive statistics also throw light on another interesting question raised by Bertillon as long ago as 1874. He indicated that multiple births were more frequent in cold than in warm climates, a finding which has been corroborated by some others since. If Negro births are excluded and the birth rate of white mothers in the United States and Canada is compared, there is a rather significant increase in twins and triplets in the Canadian group. Whether or not the reason indicated by Bertillon is the correct one, is of course, not necessarily proved.

Stillbirths showed a steep rise with increase in number of children born at a birth. In the United States, there were 29 stillbirths per thousand live berths for single children, but 70 per thousand for twins, and 145 per thousand for triplets.

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BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.
(For review)

HOWELL'S TEXTBOOK OF PHYSIOLOGY, edited by *John F. Fulton, M. D., Sterling Professor of Physiology, Yale University School of Medicine. With the collaboration of Donald H. Barron; John R. Brobeck; Robert W. Clarke; George R. Cowgill; William U. Gardner; David I. Hitchcock; Harold Lamport; David P. C. Lloyd; Leslie F. Nims; Theodore C. Ruch.* Fifteenth edition, 1,304 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1946. Price $8.

This book, one of the classics of American medicine, was originally published in 1905 by the same company. This revision is a very extensive one as there were so many new developments in physiology that it was necessary to add a number of chapters while other parts of the book have been completely re-written. Experiences of aviation medicine in the war and the changing ideas regarding altitude physiology have been included. The subject of the physiology of sex and the various sex hormones, the greater part of which has been developed since the fourteenth edition, forms a large and important section.

Every textbook has certain fields and subjects in which it is particularly outstanding. In this book, the parts devoted to physiology of the nervous system is perhaps the most remarkable and the most complete. Another outstanding part of the book is that dealing with the events of the cardiac cycle by Dr. Hoff.

Clarity and completeness, both of them characteristics of the old Howells, have been maintained throughout the entire book. The illustrative material is excellent and each chapter is followed by a considerable bibliography. The printing and format are very fine.

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SURGICAL TREATMENT OF THE MOTOR-SKELETAL SYSTEM, Supervising Editor *Frederick W. Bancroft, A. B., M. D., F. A. C. S. Associate Clinical Professor of Surgery, Columbia University; Attending Surgeon, New York City and Beth David Hospitals; Associate Editor Clay Ray Murray, M. D., F. A. C. S. Professor of Orthopedic Surgery, College of Physicians and Surgeons, Columbia University; Attending Surgeon and Chief of the Fracture Service, Presbyterian Hospital and Vanderbilt Clinic, New York City.* PART ONE: Deformities, Paralytic Disorders, Muscles, Tendons, Bursae, New Growths, Joints, Amputations. 612 pages; with 520 illustrations and a color plate. PART TWO: Fractures, Dislocations, Sprains, Muscle and Tendon Injuries, Birth Injuries, Military Surgery. 1254 pages; with 543 illustrations. J. B. Lippincott Company, Philadelphia, Pa., publishers, 1945. Price, set, $20.

This work is divided into 2 parts and bound in 2 volumes, 1 part to each. Part I has 520 illustrations and 1 color plate and Part II 543 illustrations, a total of 1064. There is an unusual profusion of pictures, mostly photographs, which fully and beautifully enhance the text. These are beautiful books, well bound and especially well printed in a clear, easily visualized type on high gloss paper and easy to hold, each containing about 600 pages plus 29 of index.

It is a pleasure to read these books. The text is complete, clearly phrased with full authoritative statements and directions and most satisfyingly instructive. The text goes along with the illustrations so that one can glance at the picture as he follows the description of the condition or procedure.

Very considerable detail is used in describing the conditions, structures, defects etc., and the treatment is meticulously stated, greatest care being taken to make all things clear. The style is the same throughout although one author follows another. The narrative is such that it inspires confidence and leaves one with the sense and feeling of sureness and certainty that the procedure or treatment is the best and the one with the greatest hope for success.

Part I covers deformities, paralytic disorders, muscles, tendons, bursae, new growth, bones, joints and amputations, each section being complete in itself.

Part II covers fractures, dislocations, strains, muscle and tendon injuries, birth injuries and war surgery, this being a thesis by the Surgeon General of the Army fully describing medical service units organization and scope of activities.

The foregoing arrangement of the subjects is a most happy one as related conditions or situations join in contiguous sequences. The contents are divided into sections and these into chapters, and for the most part each chapter is the work of a separate author and a monograph on his subject. The authors are most outstanding specialists in their field. The editor has done well in his compilation, arrangement, and editorial management of the matter so that the text flows

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like a continuous story rather than broken context as is often the case in joint publications of monographs.

This book should have unqualified recommendation for the use of specialists, practitioners, students, and should be in the hands of all medical officers of the military services.

AN INTRODUCTION TO ESSENTIAL HYPERTENTION, by *Richard F. Herndon, M. D., F. A. C. P.* 88 pages, illustrated. Charles C Thomas, Springfield, Ill. Publisher, 1946. Price $2.50.

In a small volume of eighty-nine pages, Doctor Herndon has condensed the pertinent information on the diagnosis and treatment of Essential Hypertension. He has presented his book in a very well planned form with a summary at the end of each chapter, giving a brief resume of the field covered. The book is very readable, up to date, and is recommended as a quick refresher as well as a source of reliable information for those dealing with patients with Essential Hypertension.

WAR NEUROSES, by *Roy R. Grinker, Lt. Col., M. C., and John P. Spiegel, Major, M. C., Army Air Forces.* 145 pages. The Blakiston Company, Philadelphia, Pa., publishers, 1945. Price $2.75.

This book is a reprint with minor editorial changes of an earlier text prepared and distributed for the Air Surgeon, Army Air Forces by the Josiah Macy, Jr., Foundation in September 1943.

The authors report their experience with a group of neuropsychiatric casualties encountered during the Tunisian Campaign in January–May 1943. When it was first distributed, it attracted considerable attention because it was among the first reports of its kind issued during World War II.

Whatever critical reviews this work has received can be attributed to the authors' psychoanalytical approach and treatment. Like all Freudian writing, the language used has its own peculiar and limited frame of reference which the authors take for granted is well-known and familiar to all readers.

The authors share the feeling of most modern psychiatrists that the terminology used to describe the psychiatric response to combat induced stress is phenomenological. Thus, inasmuch as the nuclear reaction is that of anxiety, Doctors Grinker and Spiegel devote their attention to an examination of the methods by which the personality attempts to deal with it.

The authors document their theses with well selected and illustrative case histories. In toto these provide a comprehensive panorama of the gamut of emotional reactions to stress.

The most significant feature of the book is that portion devoted to narcosyntheses which in the form they describe is the authors' con-

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tribution to brief psychotherapy. As subsequent experience has shown in carefully selected subjects the opportunity under controlled conditions to reintegrate traumatic emotional experiences, affords a long, sought-after short cut to the resolution of psychiatric symptoms.

Despite the academic beliefs held by differing schools of psychiatric thought, it is the opinion of this reviewer that Grinker and Spiegel's work has singular importance in the body of psychiatric data accumulated during World War II.

PSYCHOLOGY FOR NURSES, Designed and Written for Student Nurses by *Bess V. Cunningham, Ph. D., Professor of Education, University of Toledo, Toledo, Ohio.* 336 pages; illustrated. D. Appleton-Century Company, Inc., New York, N. Y., publishers, 1945. Price $3.

Psychology for Nurses would be a useful addition to any library for nurses and students should find it particularly interesting since it is written for and about nurses.

The division of the chapters into subjects is helpful to students. Instructors may gain helpful teaching suggestions by the "Suggested Activities" at the end of each chapter and an instructor in a school of nursing should find it most adaptable as a nursing text. The book is well written and very interesting. The illustrations are graphic and tend to enhance the subject material. They are simple but clear, lending interest to the reader.

The correlation of child psychology and physiology with the fundamental principles of psychology is most beneficial for nurses.

MANUAL OF PSYCHOLOGICAL MEDICINE For Practitioners and Students by *A. F. Tredgold, M. D., F. R. C. P., F. R. S. E., Consulting Physician to University College Hospital, London.* 302 pages. 2d edition. The Williams & Wilkins Company, Baltimore, Md., publishers, 1945. Price $5.

The author of the well-know textbook on mental deficiency presents the second edition of his Manual of Psychological Medicine with some revisions and additions to the original volume. The book is written from the standpoint of a strict organicist and consists of a presentation of rather straight descriptive psychiatry.

The author justifies his approach on the basis that the psychopathological approach, while undoubtedly helpful and indeed necessary for understanding the so-called functional disorders, is "certainly not that most suited to describe psychological medicine as a whole." He refers to his experience as authority for this behalf. Appearing at this time, at the close of a war in which it was demonstrated that over 90 percent of the military psychiatrists' problems were concerned with neuroses and psychopathies and less than 10 percent with the psychoses, one wonders at the wisdom of his approach. Nine pages of this 293 page book are devoted to war neuroses and their treatment.

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Like all English textbooks of psychiatry, this one furnishes good reading even though many of the author's concepts may not be generally accepted. For example, his ideas on the constitution of the human mind (page 5), some of his general considerations of the causations of mental disease (page 20, etc.), and his conclusions regarding chronic mania (page 111, etc.) would not meet with general acceptance. When it comes to a description of mental defect (to which he allots 28 pages), the author is in an authoritative position. The chapter on special forms of treatment (chapter 24) is hardly comprehensive enough for a manual of this type. Chapter 25 discusses legal relationships and is naturally enough based on English law. The last two chapters consider "Procedures, duties and responsibilities of the medical practitioner" and "Some sociological consideration." In general the book offers little to the medical officer psychiatrist.

PRINCIPLES OF DYNAMIC PSYCHIATRY by *Jules H. Masserman, M. D., Division of Psychiatry, Department of Medicine, University of Chicago.* With a Glossary of Psychiatric Terms. 320 pages; illustrated. W. B. Saunders Company, Philadelphia, Pa., publishers, 1946. Price $4.

This is a brilliant book by an author who heretofore has been best known for his work and films on experimental neuroses in animals. His purpose in writing this volume is to provide an introduction to the principles of modern dynamic psychiatry and their application to the technics of diagnosis and therapy.

It is divided into two parts. Part I considers the development of behavior theories and Part II the biodynamics of normal and abnormal hebavior. In addition there are four appendixes, the first giving an illustrative psychoanalysis of a neurotic personality, the second the psychoanalytic formulations of the psychoses, the third illustrative motion picture films and references, and the fourth a survey of some principles of group communication.

Beginning in the first chapter with a survey of the contributory fields of knowledge and the historical development of behavior, the author goes on to discuss organic theories of behavior, the psychological concept and the psychoanalytic concept of behavior. There is an excellent survey of the situation as it now stands and indicates the author's breadth of vision and extent of knowledge of his subject. The neurotogenic dynamisms and the psychotic dynamisms are also well-done.

Part II sets out to analyze the formulations of behavior which have already been dealt with and attempts to trace them to their common source in the dynamics of biological functioning. The author then endeavors to set forth the various biodynamic corollates of current theories of normal and abnormal behavior. In the discussion

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of the biodynamic corollates of current theories of behavior, the author gives an excellent review of their present status. He then states the main principles of his biodynamic theory. Principles of conflict, intensity of conflict and modes of therapy follow, as does a discussion of the biodynamic processes of language and verbal therapy. All in all it is a challenging presentation.

The illustrative psychoanalysis of a neurotic personality will be hard for many non-analysts to take, but he is perfectly honest about it all and sets forth a somewhat concentrated outline of a complete analysis. As a reportorial job on already existent theories, the book is excellent. His cases are well selected and quoted in profusion. When the author gets into philosophic concepts, as he does in various asides, he is vulnerable in spots. Evaluation of his biodynamic theory will require more time and study. He has missed very little as he proceeds and he ties up the various theoretical concepts with experimental counterparts. Hard as he has tried to keep it out however, psychiatric jargon has crept into the text a little too much. It is true the book has a glossary and it adds to it, but the technical patois will make the book less valuable for medical students and the non-psychiatrist. In addition to the glossary there is an excellent bibliography and a good index. All in all the book is well-done and certainly everyone connected with psychiatry should read it.

CLINICAL NEUROLOGY by *Bernard J. Alpers, M. D., Sc.D., (MED.) Professor of Neurology, Jefferson Medical College, Philadelphia; Neurologist to the Jefferson, Pennsylvania, and Wills Hospitals, Philadelphia.* 797 pages; illustrated. F. A. Davis Company, Philadelphia, Pa., publishers. 1945. Price $8.

This is an excellent textbook of Neurology by a distinguished, young clinician and neuropathologist. It has been long awaited. The author states that the primary purpose of the book is to make the subject intelligible to medical students and practitioners. This the reviewer believes has been done by giving a concise account of all the neurological conditions encountered in practice without cluttering up the text with unnecessary details. Professor Alpers' treatment of each subject is orthodox. He begins with the etiology and pathology of the condition under consideration and proceeds to the symptoms, diagnosis, and treatment. Tables of differential diagnoses are appended to each chapter and should be of great assistance to the student. Outlines of each chapter precede the body of the discussion.

It is difficult to review this text of Neurology, as it is difficult to review all such texts, because the temptation is to comment upon every chapter and compare it with other texts. This, of course, would make the review top-heavy and akin to another textbook. Suffice it to say that nothing has escaped the practiced eye of this author. The book is well written. The illustrations and the tables are excellent. The

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first 3 chapters, consisting of the Examination of the Nervous System, the Interpretation of Neurological Symptoms and Signs, and the Topical Diagnosis of Nervous Disease, could be read with profit by every practitioner of medicine.

One more thing can be said about the book, namely, that the author does not gratuitously throw in a chapter on the Psychoneuroses, as is frequently done in Neurological texts. This chapter usually seems so orphaned and isolated and cold that it loses its worth. This author sticks to straight Neurology and his work gains by so doing.

The book is enthusiastically recommended to students and practitioners.

NEUROSYPHILIS by *H. Houston Merritt, A. B., M. A. (Hon.) M. D., Professor of Clinical Neurology, College of Physicians and Surgeons, Columbia University; Chief of Neuropsychiatric Division, Montefiore Hospital, New York City; Raymond D. Adams, M. A., M. D., Neuropathologist and Visiting Neurologist, Boston City Hospital; Associate in Neurology, Harvard Medical School; Consultant Neurologist, Pratt Diagnostic Hospital; Lecturer in Neurology, Tufts Medical School; and Harry C. Solomon, B. S., M. D., Professor of Psychiatry, Harvard Medical School; Medical Director, Boston Psychopathic Hospital, Boston, Massachusetts.* 443 pages, illustrated. Oxford University Press, New York, 1946. Price $11.

This volume presents the combined work of two neurologists and a psychiatrist on the subject of neurosyphilis, an approach to the problem which in recent years has been somewhat neglected with the advent of the new therapeutic aids. The treatment of syphilis, the authors state, has passed into other hands, and as a result many of the practical aspects of neuropathology and clinical neuropsychiatry have been neglected. The caliber of this volume may be surmised by a consideration of its authors, each of whom is outstanding in his special field.

The early chapters present the general considerations and classification of neurosyphilis, meningeal neurosyphilis (cerebral), and asymtomatic neurosyphilis. Numerous case histories are cited and the bibliography is comprehensive. The fifth chapter is on Cerebral Vascular Neurosyphilis, and in it there are some fine tables and discussions of the syndromes of cerebral arteries. Paretic and Tabetic Neurosyphilis are considered in the seventh and eighth chapters, while the remaining chapters discuss Congenital Neurosyphilis, Trauma and Neurosyphilis, Puzzles and Errors, and a discussion of Cerebrospinal Fluid. The chapter on Puzzles and Errors is concerned with differential diagnosis. In it is presented a series of cases which were complicated and in which the likelihood of error was great. This chapter is particularly valuable for everyone who has dealth with neurosyphilis and realizes the difficulty when asymptomatic neurosyphilis is complicated by the presence of non-syphilitic diseases, or when some form of neurosyphilis occurs with a negative cerebrospinal fluid. The last chapter is concerned with treatment.

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PRESCRIBING OCCUPATIONAL THERAPY, by *William Rush Dunton, Jr., M. D.* 2d edition. 144 pages. Charles C Thomas, Springfield, Illinois, publishers, 1945. Price $2.50.

The purpose of the author of this book was to present the subject briefly so "that it might be quickly apprehended by the busy physician or medical student" or perhaps as a manual. However the textual contents lack substance and one is left with a feeling of vagueness after reading them.

This book endeavors to advance the cause of so-called occupational therapy, a misnomer; it tries to combine the occupational with psychic influences which are better left to another field. It also endeavors to justify the occupational therapeutist or more properly technician, who is given to conducting various forms of diversional procedures as well as exercises to be carried out by the patient rather than applied by the technician.

The word "occupation" is used instead of diversion, entertainment or similar designation of physical means to the end sought, and such expressions as psychotherapy, music therapy or other prefixes to the word therapy cover a multiude of approaches to various problems.

The presentation of the subject is quite superficial and unstimulating, and interest flags, yet the book is intended to arouse interest in the field and to serve as a guide, although the author admits "brevity has been purposely sought." Much of the text is a presentation of axiomatic statements rather than direct instructions or outline of methods.

The author would do better by swinging to the more universal title of physical medicine to cover the physical and mechanical measures for one part of the book, and to a second part which would include the psychologic and emotional analysis as an approach to the application of treatment which governs this phase of the patient's condition.

The book is not recommended for more than an introduction for technicians.

ATLAS OF SURGICAL APPROACHES TO BONES AND JOINTS, by *Toufick Nicola, M. D., F. A. C. S. Professor of Orthopedics, New York Polyclinic Post Graduate School and Hospital; Diplomate of American Board of Orthopaedic Surgery; with a foreword by Norman T. Kirk, Major General, U. S. Army, The Surgeon General.* 218 pages, 227 illustrations. The McMillan Company, New York, publishers, 1945. Price $5.

This book comprises a presentation of most realistic drawings of actual anatomical structures in their proper relationship to each other, all shown as they would appear to the eye, view of the field of operation and as each would come into view when successive layers are retracted or exposed. This portrayal tends to establish in the "mind's eye" a mental picture easily recalled by the operator.

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The technic used is exceptional. Muscle fibers are drawn in the direction of their line from source to points of attachment. Where bones underlie tissues they are shown in dotted lines displaying the whole bone in shape and size. Joint capsules are indicated as vacant spaces about the articulating surfaces or as broad bands. Ligaments are shown as narrow bands passing from one point of attachment to another. Certain cross sections through the tissues surrounding the spinal column are pictures in black masses suggesting a map in relief. The courses of arteries, veins and nerves are clearly placed and exposed in their anatomical relation to each other or other structures.

Incisions at appropriate places, straight, curved, angulated or otherwise are overlaid on the joints or tissues they are intended to expose, in such a way that not only the anatomical relationship of underlying structures can be visualized but also the details of them, as the surgical procedure advances.

The delineation of all drawings or illustrations is clear, distinct and beautifully executed. In fact this is a most unusual and useful work which should be a joy to any surgeon, no matter how expert, and most of all to the young medical student and practitioner who would learn surgery.

There is little text but it is all devoted to a succinct statement of action and movement as one performs the operative procedure on bones and joints at its best. It is commended to those engaged in the practice for guidance and to others for pleasure in viewing excellent drafting.

THE EXTREMITIES by *Daniel P. Quiring, Ph. D., head of the Anatomy Division, Cleveland Clinic Foundation and Associate Professor of Biology, Western Reserve University; Beatrice A. Boyle, artist, Cleveland Clinic Foundation; Erna L. Borough, M. A., Fellow Anatomy Division, Cleveland Clinic Foundation; and Bernardine Lufkin, A. B., former secretary Research Division, Cleveland Clinic Foundation.* Illustrated with 106 engravings. Lea & Febiger, Philadelphia, 1945. Price $2.75.

This new volume should be a very valuable and interesting aid to medical student and practitioner, as an adjunct to his Gray or Cunningham.

It is a 117-page primer of black-and-white depictions of muscle origin and insertion, and nerve and arterial supply, of the extremities. Each muscle is represented diagramatically, with absence of confusing backgrounds and relationships; at bottom of each plate is a table concisely itemizing the afore-mentioned points, together with function, with a listing of page references to both Gray and Cunningham.

The chief objective of the authors has been to emphasize the major termini of the muscles and the chief arteries and nerves which are related to them. For this reason they have avoided any confusing excess of detail of attachments, or minor vessels or nerves.

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The small outlay for this student's assistant will be returned many times over.

TEXTBOOK OF PEDIATRICS, Edited by *Waldo E. Nelson, M. D., Professor of Pediatrics, Temple University School of Medicine;* with the collaboration of 49 contributors. 1,350 pages; 519 illustrations on 333 figures, 26 in color. 4th edition, revised. W. B. Saunders Co., Philadelphia, Pa., publishers, 1945. Price $10.

The new Mitchell-Nelson Textbook of Pediatrics is an outstanding achievement. Waldo Nelson, Professor of Pediatrics at Temple University and formerly closely associated with the late A. Graeme Mitchell at Cincinnati, accepted the editorship of the fourth edition of the single volume textbook, previously called Griffith and Mitchell.

As is the present custom, there are numerous collaborators, 49 authorities on various subjects with the editor-in-chief (Nelson) contributing many of the sections and shaping the material into a unified work. Therefore it is really a "new" book, which upholds the fine tradition of the previous editors.

This book, while not too complicated for the medical student of today, is admirably suited to the needs of the pediatrician and the general practitioner who wants up-to-date, detailed information, without wading through the more extensive "Systems of Pediatrics." The reviewer highly recommends the book.

PHYSICAL CHEMISTRY OF CELLS AND TISSUES, by *Rudolf Hoer, University School of Medicine, Philadelphia, Pa.* With the collaboration of *David I. Hitchcock, Yale University School of Medicine, Laboratory of Physiology, New Haven, Conn.; J. B. Bateman, Mayo Clinic, Rochester, Minn.; David R. Goddard, University of Rochester, Biological Laboratories, Rochester, N. Y., and Wallace O. Fenn, University of Rochester, School of Medicine and Dentistry, Rochester, N. Y.*, 675 pages. The Blakiston Co., Philadelphia, Pa., publishers. 1945. Price $9.

This book is a highly specialized thesis on the chemistry and physiology of cells and tissues and is extremely difficult to review due to the detailed information and numerous equations. If the reader has a thorough knowledge of the basic sciences, including physical and electro-chemistry, he will find this book worth reading. It is extremely valuable to the investigator who desires detailed information on the various subjects discussed in this book. The clinician interested in research will find it very helpful in studying the chemistry of the body.

The first eight chapters (186 pages) deal with physical and electrochemistry. The colloidal chemist would enjoy reading Chapter 9 which is a well-written explanation of the properties of films and membranes. The bio-chemist can obtain much useful information from the chapter on intestinal absorption, which includes the absorption of the salts as well as the monosaccharides and the amino acids.

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The clinician probably would gain considerably by reading the chapter on the chemistry of respiration which includes the respiratory enzymes and the explanation as to the origin of carbon dioxide in the body. The chapter on the formation of urine, with an explanation of glomeruli and tubular function, would also interest the clinician. The authors of this book present the question of the permeability of tissue cells, including the permeability of cells to the electrolytes, in a very comprehensive way.

HEMATOLOGY FOR STUDENTS AND PRACTITIONERS, by *Willis M. Fowler, A. B., M. D., Professor of Internal Medicine, University of Iowa, Iowa City.* With a chapter by *Elmer L. Degowin, A. B., M. D., Assistant Professor of Internal Medicine, University of Iowa, Iowa City.* Paul B. Hoeber, Inc., New York, N. Y., publishers, 1945. 499 pages; illustrated. Price $8.

Textbooks on hematology are not so abundant as to make a new addition to their number redundant. And no subspecialty has grown more in importance in recent years than has the study of the blood, its clinical indications, and its laboratory disclosures.

This new volume has grown from lectures and studies of the past decade, and on finally reaching book form shows the results of mature consideration and analysis. By this the best points and procedure are properly emphasized and academic controversy bypassed.

It is foremost an excellent clinical guide for the practitioner, presenting hematologic methods sufficiently to satisfy that aspect, but is not intended as an elaborate laboratory treatise. The opening chapters, however, on the hematopoietic system are extremely well done, with blood elements and normal hematologic values thoroughly covered by pen and brush and camera.

The volume is a pleasure to handle in its binding, paper, and type. The combination of Hoeber and Harper and Brothers has probably not produced any more valuable or creditable volume. It is heartily recommended to the general practitioner.

THE PHYSICIAN'S BUSINESS, by *George D. Wolf, M. D., Assistant Clinical Professor of Otolaryngology, New York Medical College, New York. Fellow, New York Academy of Medicine and American Medical Association. Foreword by Harold Rypins, A. B., M. D., F. A. C. P.* 2d edition, 433 pages; 58 illustrations in the text. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1945. Price $6.

This book should be in the hands of every doctor or dentist. It covers his professional life and affairs, and his requirements—even to office equipment and procedures of treatment—office personnel, the handling of accounts, and collection of fees. It takes the doctor from internship through a life of practice to the end of his career. It is one of the most complete publications of its kind.

At the beginning there is discussion of internships, appointments to and choice of hospitals, the types and merits of various services, of

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careers other than private practice, and advice on specialization, location for practice, professional relations, contacts and ethics, consultations, correspondence, reports and records, and other public relations.

The relation of the professional man to his patients, the type and kind of records of the cases, sample forms, methods of filing, suggested entries and notes on the records, are well and plainly covered. There is a complete schedule of fees divided into sectional headings covering treatments, operations, examinations and consultations, so that one desiring to use a standard universal fee schedule can refer to it. Numerous form or type letters to be used in fee collecting are set forth as guides in the matter.

Another interesting and useful chapter on detailed written instructions to patients is very fully covered, even to a set of physical exercises accompanied by diagrammatic illustrations of each posture. This is followed by a statement of the *how* in preparation of measures such as the application of mustard plasters and preoperative procedures.

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PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge

MEDICAL SURVEYS FOR PULMONARY TUBERCULOSIS

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During the period March 1944 to October 1945 there were 3,494 individuals of the Navy and Marine Corps with a diagnosis of pulmonary tuberculosis whose Reports of Medical Survey were processed in the Bureau of Medicine and Surgery. The earliest date on any survey was January 1944 and the latest date October 1945. The latest survey was used if there had been more than one survey for the condition, but previous surveys were reviewed for additional information.

In each case, when possible, the photofluorogram of the chest made at, or soon after, entry on active duty, was reviewed. Of the total number, 1,751, or 50 percent, of the records contained a photofluorogram.

The results of the processing of these Reports of Medical Survey are shown in the tables following and are briefly commented upon.

There appears to be no real difference between officers and enlisted men in the severity and the activity of the disease. As might be expected moderately advanced and far advanced disease comprises a large part of all the cases since the disease in its course has ordinarily progressed extensively before clinical symptoms and signs raise suspicion of its presence. However, the cases of minimal tuberculosis, almost exclusively discovered through the effort of x-ray case-finding, amount to 37.5 percent and speak well for the fine progress made through tuberculosis control measures begun in January 1942 and expanded in

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TABLE 1.—*Number and percent by diagnoses according to most recent pulmonary tuberculosis medical survey, Navy and Marine Corps officers and enlisted men, March 1944–October 1945*

Diagnoses	Number			Percent		
	Total	Officers	Enlisted	Total	Officers	Enlisted
Total	3,494	433	3,061	100.0	100.0	100.0
Primary, active	10	3	7	.3	.7	.2
Primary, healed	118	15	103	3.4	3.5	3.4
Minimal, active	415	54	361	11.9	12.5	11.8
Minimal, arrested	894	113	781	25.6	26.1	25.5
Moderately advanced, active	1,168	152	1,016	33.4	35.1	33.2
Moderately advanced, arrested	348	55	293	9.9	12.7	9.6
Far advanced, active	532	40	492	15.2	9.2	16.0
Far advanced, arrested	9	1	8	.3	.2	.3

June 1944. During the period in which the surveys reported here were being processed, photofluorographic units were gradually being installed in the various continental stations, and one unit was in operation in the Pacific area. It is confidently expected that succeeding reviews of the Reports of Medical Survey will demonstrate an ever growing percentage in the minimal stage of the disease.

Forty-five percent of the patients surveyed for tuberculosis were less than 25 years of age and 65 percent were under 30. In many instances personnel in the older age groups had received the first routine chest x-ray of their naval careers, thereby learning of previously unsuspected lesions. An attempt was made to determine in-

TABLE 2.—*Number and percent by age in years according to most recent pulmonary tuberculosis medical survey, Navy and Marine Corps, March 1944–October 1945*

	Age in years									
	Less than 20	20–24	25–29	30–34	35–39	40–44	45–49	50 & over	Not stated	Total
Number	402	1,174	701	452	350	218	117	74	6	3491
Percent	11.5	33.6	20.1	12.9	10.0	6.2	3.4	2.1	0.2	100.0

cidence rates for both officers and men, but due to the great shift in strength figures during the period, no reliable results were obtained.

Although not shown in this table, 176, or 5 percent, of the surveys were for Negroes. From the strength figures available, it cannot be said that they had more or less tuberculosis than did the non-Negro group.

Table 3 gives the months of service before being admitted to the sick list for tuberculosis, and the source of the lesion. As expected, when service was short the lesion had existed prior to enlistment; as the amount of service increased more of the lesions were service-connected. The cases with practically no service can be questioned,

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TABLE 3.—*Number and percent by months of service and source of lesions according to most recent pulmonary tuberculosis medical survey, Navy and Marine Corps, March 1944–October 1945*

Months of service	Number					Percent				
	Total	Source of lesion				Total	Source of lesion			
		Line of duty	EPTE aggravated	EPTE not aggravated	Not stated		Line of duty	EPTE aggravated	EPTE not aggravated	Not stated
Total	3,494	2,572	98	823	1	100.0	73.6	2.8	23.6	0.0
Less than 1	11			11		0.3			100.0	
1–1.9	262	14	3	245		7.5	5.3	1.2	93.5	
2–2.9	103	10	3	90		3.0	9.7	2.9	87.4	
3–5.9	190	61	9	120		5.4	32.1	4.7	63.2	
6–11.9	337	233	20	84		9.6	69.2	5.9	24.9	
12–23.9	949	758	34	156	1	27.2	79.9	3.6	16.4	0.1
24–35.9	829	729	21	79		23.7	88.0	2.5	9.5	
36 or more	561	516	8	37		16.1	92.0	1.4	6.6	
Not stated	252	251		1		7.2	99.6		.4	

there being three sources of error: The survey typed incorrectly, the survey coded incorrectly, or the card punched incorrectly. There were 10 percent with less than 3 months of service prior to admission to the sick list, but 70 percent had had at least 1 year of service. It was found that officer and enlisted groups differed in length of service, but since the officers may have had some service as enlisted men, the comparison was considered unreliable.

TABLE 4.—*Number by diagnosis and days on sick list before first survey according to most recent pulmonary tuberculosis medical survey, Navy and Marine Corps, March 1944–October 1945*

Diagnosis	Total		Days before survey								
	Number	Percent	0–7	8–14	15–21	22–28	29–35	36–42	43–49	50 or more	Not stated
Total	3,494	100.0	286	178	185	169	149	132	130	2,259	6
Primary, active	10	.3	1	3				2	1	3	
Primary, healed	118	3.4	31	5	8	6	5	6	9	48	
Minimal, active	415	11.9	26	17	23	27	23	9	22	267	1
Minimal, arrested	894	25.6	71	43	56	48	50	40	45	541	
Moderately advanced, active	1,168	33.4	58	61	51	45	53	43	31	825	1
Moderately advanced, arrested	348	9.9	77	20	19	21	10	19	12	167	3
Advanced, active	532	15.2	22	29	27	21	7	12	9	404	1
Advanced, arrested	9	.3			1	1	1	1	1	4	

Table 4 shows the number of days that elapsed between date of admission to the sick list and the date of the first, or only, survey. Sixty-five percent of the cases were studied for approximately 2 months before the survey was held. There appears to have been a rather hasty determination of arrest in the minimal cases. Of the 894 instances in which the diagnosis was made, 218 were, it appears, studied for less than 29 days, and 71 were studied less than 8. It is quite likely

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that a portion of these examinations was made during the physical examination made at, or soon after enlistment or commission, and another portion can be explained by the omission from the diagnostic nomenclature of an item indicating "activity undetermined." Certainly a most detailed and painstaking study of all persons in the service with minimal lesions or lesions represented by "suspicious shadows" is indicated so that the golden opportunity for beginning treatment may not be lost.

TABLE 5.—*Number by months of service and days on sick list before first survey according to most recent pulmonary tuberculosis medical survey, Navy and Marine Corps, March 1944–October 1945*

Months of service	Total		Days before survey								
	Number	Percent	0–7	8–14	15–21	22–28	29–35	36–42	43–49	50 or more	Not stated
Total	3,494	100.0	286	178	185	169	149	132	130	2,259	6
Less than 1	11	.3	4	3	3	.....	.....	.....	.....	1	.....
1–1.9	262	7.5	99	29	22	23	20	14	7	46	2
2–2.9	103	3.0	55	7	5	5	2	2	4	23	.....
3–5.9	190	5.4	36	5	10	7	9	14	9	98	2
6–11.9	337	9.6	11	17	18	20	14	9	18	230	.....
12–23.9	949	27.2	25	40	37	33	37	41	32	704	.....
24–35.9	829	23.7	24	32	52	43	29	30	31	588	.....
36 or more	561	16.1	18	22	26	26	28	13	19	407	2
Not stated	252	7.2	14	23	12	12	10	9	10	162	.....

One thousand seven hundred and seventy-eight of the 3,494 cases were on duty from 1 to 3 years prior to admission to the sick list for pulmonary tuberculosis.

TABLE 6.—*Number and percent by length of service and place of admission to sick list according to most recent pulmonary tuberculosis medical survey, Navy and Marine Corps, March 1944–October 1945*

Length of service	Number					Percent				
	Total	Place of admission				Total	Place of admission			
		United States	Ships	Foreign bases	Not stated		United States	Ships	Foreign bases	Not stated
Total	3,494	1,987	895	611	1	100.0	56.9	25.6	17.5	0.0
Less than 6 months	566	527	21	18	.....	16.2	93.1	3.7	3.2	.....
6 to 11 months	337	195	80	62	.....	9.7	57.9	23.7	18.4	.....
1–1.9 years	949	445	260	244	.....	27.2	46.9	27.4	25.7	.....
2–2.9 years	829	407	254	168	.....	23.7	49.1	30.6	20.3	.....
3–3.9 years	309	154	108	47	.....	8.8	49.8	35.0	15.2	.....
4 or more years	252	115	98	39	.....	7.2	45.6	38.9	15.5	.....
Not stated	252	144	74	33	1	7.2	57.1	29.4	13.1	.4

During the first 6 months of service most of the cases were discovered in the United States. After this period an increasing number of the cases was first reported from ships and foreign stations. Many

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persons in the longer service group had left this country before either the recruit film or the annual film were in wide use, hence it cannot be inferred that they necessarily contracted the disease as a result of exposure during their period of foreign or sea duty. In approximately 50 percent of the series the disease was discovered during the second and third year of active duty, and less than 8 percent were found in those with 4 or more years of service.

TABLE 7.—*Number and percent by diagnosis and place of admission to sick list according to most recent pulmonary tuberculosis medical survey, Navy and Marine Corps, March 1944–October 1945*

Diagnosis	Number					Percent				
	Total	Place of admission				Total	Place of admission			
		United States	Ships	Foreign bases	Not stated		United States	Ships	Foreign bases	Not stated
Total	3,494	1,987	895	611	1	100.0	56.9	25.6	17.5	0.0
Primary, active	10	7	2	1		0.3	70.0	20.0	10.0	
Primary, healed	118	89	21	8		3.4	75.4	17.8	6.8	
Minimal, active	415	268	81	65	1	11.9	64.6	19.5	15.7	.2
Minimal, arrested	894	601	187	106		25.6	67.2	20.9	11.9	
Moderately advanced, active	1,168	550	354	264		33.4	47.1	30.3	22.6	
Moderately advanced, arrested	348	262	44	42		9.9	75.3	12.6	12.1	
Far advanced, active	532	205	204	123		15.2	38.5	38.4	23.1	
Far advanced, arrested	9	5	2	2		.3	55.6	22.2	22.2	

Most of the minimal disease was uncovered in the United States, where case-finding programs were widely utilized. However, the photofluorographic unit at Pearl Harbor contributed its full share in minimal cases. It is evident that the arrested advanced lesions were discovered largely through mass x-ray examinations and during the investigation of symptoms referable to other diseases.

TABLE 8.—*Number and percent by source of lesion and place of admission to sick list according to most recent pulmonary tuberculosis medical survey, Navy and Marine Corps, March 1944–October 1945*

Source of lesion	Number				Percent			
	Total	Place of admission			Total	Place of admission		
		United States	Ships	Foreign bases		United States	Ships	Foreign bases
Total	3,494	1,988	895	611	100.0	56.9	25.6	17.5
Line of duty	2,572	1,255	800	517	73.6	48.8	31.1	20.1
EPTE aggravated	98	54	23	21	2.8	55.1	23.5	21.4
EPTE not aggravated	824	679	72	73	23.6	82.4	8.7	8.9

The service-connected cases were about equally divided between continental stations and ships and foreign bases.

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TABLE 9.—*Number and percent by diagnosis and source of lesion according to most recent pulmonary tuberculosis medical survey for total Navy and Marine Corps, March 1944–October 1945*

Diagnosis	Number					Percent				
	Total	Source of lesion				Total	Source of lesion			
		Line of duty	EPTE aggravated	EPTE not aggravated	Not stated		Line of duty	EPTE aggravated	EPTE not aggravated	Not stated
Total	3,494	2,572	98	823	1	100.0	73.6	2.8	23.6	0.0
Primary, active	10	6		3	1	.3	60.0		30.0	10.0
Primary, healed	118	43	1	74		3.4	36.4	.9	62.7	
Minimal, active	415	338	12	65		11.9	81.4	2.9	15.7	
Minimal, arrested	894	459	25	410		25.6	51.3	2.8	45.9	
Moderately advanced, active	1,168	1,062	36	70		33.4	90.9	3.1	6.0	
Moderately advanced, arrested	348	166	5	177		9.9	47.7	1.4	50.9	
Far advanced, active	532	493	19	20		15.2	92.6	3.6	3.8	
Far advanced, arrested	9	5		4		.3	55.6		44.4	

Many more of the active cases developed in line of duty than did the arrested cases.

TABLE 10.—*Number and percent by diagnosis and disposition according to most recent pulmonary tuberculosis medical survey, all Navy and Marine Corps, March 1944–October 1945*

Diagnosis	Number						Percent					
	Total	Disposition					Total	Disposition				
		Duty	Limited duty	Further treatment	I. S.	Other		Duty	Limited duty	Further treatment	I. S.	Other
Total	3,494	54	82	278	2,903	177	100.0	1.5	2.3	8.0	83.1	5.1
Primary, active	10			3	7		.3			30.0	70.0	
Primary, healed	118	5	3	1	105	4	3.4	4.3	2.5	.8	89.0	3.4
Minimal, active	415	1	3	47	343	21	11.9	.2	.7	11.3	82.7	5.1
Minimal, arrested	894	35	51	14	765	29	25.6	3.9	5.7	1.6	85.6	3.2
Moderately advanced, active	1,168		8	146	953	61	33.4		.7	12.5	81.6	5.2
Moderately advanced, arrested	348	12	16	5	291	24	9.9	3.5	4.6	1.4	83.6	6.9
Far advanced, active	532	1	1	61	431	38	15.2	.2	.2	11.5	81.0	7.1
Far advanced, arrested	9			1	8		.3			11.1	88.9	

Eighty-three percent of the active cases have been invalided from the service and 8 percent have been retained for further treatment.

The sputum smears, physical signs, history of contact, the tuberculin skin test, history of former disease, and gastric lavage were recorded in the Reports of Medical Survey in the order named as follows:

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TABLE 11

	Sputum	Gastric lavage	Skin test	Physical signs	Past history	History of contact
Positive	1,525	93	270	1,183	208	305
Negative	1,530	842	42	1,214	1,084	888
Not Stated	439	2,559	3,182	1,097	2,202	2,301
Total	3,494	3,494	3,494	3,494	3,494	3,494

Assuming that Boards of Medical Survey reported all data considered pertinent to the diagnosis, it might be commented that wider use of the tuberculin test, the gastric lavage, and the concentrated sputum specimen is desirable. It is of interest that a third of those whose contact history is known had been intimately exposed to a patient ill with pulmonary tuberculosis.

Approximately one-third of the total cases were admitted to the sick list as a result of a photofluorographic examination of the chest.

It is irrefutable that the photofluorograms of the chest made at induction centers and recruit training centers as part of the physical examination to determine fitness for military service excluded thousands of persons with evidence of pulmonary disease and thereby were of invaluable assistance to the individuals concerned, the military services, and the Nation. Approximately 1 percent of the persons examined by x-ray for the first time at induction centers and recruit training centers were rejected for reinfection tuberculosis.

TABLE 12.—*Number and percent by results of a review of the preservice film for pulmonary tuberculosis cases with medical surveys, Navy and Marine Corps officers and enlisted men, March 1944–October 1945*

Film reading at review	Number			Percent		
	Total	Officer	Enlisted	Total	Officer	Enlisted
Total	3,494	433	3,061	100.0	100.0	100.0
Positive	593	32	561	33.9	50.8	33.2
Negative	887	24	863	50.6	38.1	51.1
Suspicious	220	6	214	12.6	9.5	12.7
Unsatisfactory	51	1	50	2.9	1.6	3.0
Film not made or not available	1,743	370	1,373	----	----	----

One thousand seven hundred and fifty-one records contained a photofluorographic film made just prior to, or soon after, entering active service. Of these, only 50 percent were reinterpreted as normal. Thirty-four percent revealed findings which, if corroborated by a 14 x 17 inch film of the chest, would be definitely disqualifying. The remaining 16 percent were either suspicious of disqualifying conditions or technically unsatisfactory. It is probable, therefore, that had

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interpretation been nearly perfect, and if every person had received the x-ray examination, only the present series of medical surveys would have been required. Certainly mass examinations of the chest by photofluorography require a high quality of interpretation and painstaking care.

SUMMARY

Three thousand four hundred and ninety-four reports of medical survey received in the Bureau of Medicine and Surgery during the period from March 1944 to October 1945 have been reviewed with other records contained in the files of the individuals concerned and pertinent data have been presented. It is believed that such is of interest to members of the Boards of Medical Survey and to those interested in problems entailed in pulmonary tuberculosis and in mass x-ray examination of the chest.

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Lusskin, Harold, Commander (MC) USNR (*Fractures of the Shaft of Femur*, p. 888). M. D., Columbia University College of Physicians and Surgeons, 1919. Intern, 1919–20, and orthopedic staff, 1922–, Beth Israel Hospital, New York City; resident in orthopedics, Jan.–Aug, 1921, and orthopedic staff, 1922–, Hospital for Joint Diseases, New York City; consultant orthopedic surgeon, Good Samaritan Hospital, Suffern, N. Y. Fellow: American Medical Association and American Academy of Orthopaedic Surgeons. Diplomate American Board of Orthopaedic Surgery.

Noehren, Theodore H., Lieutenant (MC) USNR (*Malaria in Panama*, p. 877). B. A., Williams College, 1938; M. D., University of Rochester School of Medicine and Dentistry, 1942. Intern, Deaconess Hospital, Buffalo, N. Y., 1942–43. Member: Medical Association of the Isthmian Canal Zone and American Society of Tropical Medicine. Diplomate National Board of Medical Examiners.

Novacovich, George G., Lieutenant, junior grade (MC) USNR (*Observations and Data on Prevention of Poison-oak Dermatitis*, p. 811). A. B., Stanford University, 1932; M. D. Stanford University School of Medicine, 1937. Intern, Mary's Help Hospital, San Francisco, Calif., 1936–37; house officer, St. Francis Hospital, San Francisco, 1937–38; staff, Mary's Help Hospital and St. Francis Hospital; private practice, San Francisco, 1938–44. Fellow American Medical Association.

Perlmutter, Irwin, Lieutenant Commander (MC) USNR (*Trivial Symptoms Following Extensive Skull Fracture*, p. 911). B. A., Columbia University, 1937; M. D., Columbia University College of Physicians and Surgeons, 1941. Intern, Kings County Hospital, Brooklyn, N. Y., 1941–42.

Philbrook, Frank R., Commander (MC) USNR (*Aerodontalgia Occurring During Oxygen Indoctrination in the Low Pressure Chamber*, p. 845). M. D., Boston University School of Medicine, 1935. M. P. H., Harvard University School of Public Health, 1940. Intern, pathology, 1935–36, and intern, medical and surgical services, 1936–37, Massachusetts Memorial Hospitals, Boston, Mass.; resident physician, Somerville Hospital, Somerville, Mass., 1937; epidemiologist, Massachusetts Department of Public Health, Boston, 1937–(on military leave of absence); instructor in bacteriology, pathology, and thanatology, New England Institute of Sanitary Science and Embalming, 1933–38. Member: Massachusetts Medical Society, Massachusetts Public Health Association, American Public Health Association, and Aero Medical Association of the United States.

Reynolds, Orr E., Lieutenant, junior grade H(S) USNR (*Aerodontalgia Occurring During Oxygen Indoctrination in the Low Pressure Chamber*, p. 845). B. S., 1941, and M. S., 1943, University of Maryland. Graduate fellow, physiology department, University of Maryland, 1939–43; assistant physiologist, National Institute of Health, United States Public Health Service, 1943–44. Member Aero Medical Association.

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Sammis, Arnold F., Jr., Lieutenant (MC) USNR (*Ophthalmic Disease Treated With Penicillin*, p. 912). A. B., Dartmouth College, 1935; M. D., University of Rochester School of Medicine and Dentistry, 1939. Intern in surgery, Long Island College Hospital, Brooklyn, N. Y., 1939–40; assistant resident in pathology, New York Post-Graduate Medical School and Hospital, New York City, 1940–41; assistant resident surgeon, 1941–43, resident surgeon, 1943–44, Long Island College Hospital, Brooklyn, N. Y.

Shaw, H. Merrill, Commander (MC) USNR (*A Heavy-Duty, High-Capacity, Portable Suction Pump for Surgical Use*, p. 919. Ph. G., Ph. C., and B. S., University of Washington, 1924; M. B., University of Minnesota, 1930; M. D., University of Minnesota Medical School, 1931. U. S. Veterans' Bureau, 1924–27; intern, 1931–32, and surgical resident, 1932–33, King County Hospital, Seattle, Wash.; postgraduate work in surgery, Cook County Hospital, Chicago, Ill., 1937; surgeon, King County Hospital, 1935–41; staff, Seattle General Hospital and Columbus Hospital, Seattle; visiting staff, Swedish Hospital, Seattle. Fellow American Medical Association; member: Washington State Obstetrical Association, Washington State Medical Association, and King County Medical Society.

Stoeffler, Walter, Commander (MC) USNR (*Partitioning of Barracks*, p. 885). M. D., Indiana University School of Medicine, 1925. Intern, Indianapolis City Hospital, Indianapolis, Ind., 1925–26; house officer, pediatrics, Boston City Hospital, Children's Hospital, and Infants' Hospital, Boston, Mass., 1926–29; private practice, pediatrics, Indianapolis, 1929–42. Diplomate American Board of Pediatrics.

Stubenbord, William D., Commander (MC) USNR (*Hookworm Disease in Infants*, p. 915). B. S., Wesleyan University, 1927; M. D., Cornell University Medical College, 1931. Intern, July 1931–Aug. 1932, assistant resident, Aug. 1932–Sept. 1933, and assistant attending physician, 1943, New York Hospital; associate visiting physician, 1942, Bellevue Hospital. Fellow: American College of Physicians, American Medical Association, and New York Academy of Medicine; member New York County Medical Society. Diplomate: National Board of Medical Examiners and American Board of Internal Medicine.

Sulzberger, Marion B., Captain (MC) USNR (*Comparative Evaluation of Preparations for the Prophylaxis and Treatment of Fungous Infections of Feet*, p. 822). B. S., Harvard University, 1916; B. M. S., Sorbonne, Paris, 1922; M. D., Universität Zurich Medizinische Faukultät, 1926. Assistant, University Clinic (dermatology and syphilology), Zurich, 1926–29; Breslau, 1929; instructor in dermatology, 1929–35, assistant professor in clinical dermatology, 1935–38, and assistant clinical professor in dermatology and syphilology, 1938, associate attending dermatologist, 1935–38, attending dermatologist, 1938, associate director, skin and cancer unit, 1946–, New York Post-Graduate Medical School and Hospital; associate attending dermatologist Montefiore Hospital for Chronic Diseases, New York City, 1931–; director dermatology and syphilology department, 1934–38, and consultant in dermatology, 1938, French Hospital, New York City; visiting physician, Goldwater Memorial Hospital for Chronic Diseases, Welfare Island, New York City, 1941–; research associate in medicine, Cornell University Medical College, 1942–. Fellow: American Medical Association, and New York Academy of Medicine; member American Dermatological Association; American Academy of Dermatology and Syphilology, American Association for the Study of Allergy, American Association

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of Immunologists, Bronx Dermatological Society, Society for Experimental Biology and Medicine, Society for Investigative Dermatology, and Society for Research in Psychosomatic Problems. Editor, Year Book of Dermatology and Syphilology, Year Book Publishers, Inc., Chicago, 1931–; Board of Editors, Journal of Allergy, Psychosomatic Medicine, Dermatologica; editor, Journal of Investigative Dermatology, 1938–. Author, Dermatologic Allergy, Charles C Thomas, Springfield, Ill., 1938; coauthor Dermatologic Therapy in General Practice, Year Book Publishers, Inc., Chicago, 1940; 2d edition, 1942; coauthor Manual of Dermatology (Military Medical Manuals, National Research Council), W. B. Saunders Co., Philadelphia, 1942.

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Werner, A. Yvonne, Lieutenant, junior grade H(S) USNR (*Aerodontalgia Occurring During Oxygen Indoctrination in the Low Pressure Chamber*, p. 845). B. S., American University, 1944.

White, Benjamin V., Jr., Lieutenant Commander (MC) USNR (*Shigellosis Studies*, p. 901; *Malnutrition in Repatriated Prisoners of War*, p. 793). B. A., Princeton University, 1930; M. D., Harvard Medical School, 1934. Intern, Peter Bent Brigham Hospital, Boston, June 1934–Nov. 1935, and New Haven Hospital, New Haven, Conn., Jan.–Sept. 1936; Jeffrey Richardson Fellow, Harvard Medical School, 1936–38; assistant to pathologist, 1938–39, clinical assistant in medicine, 1938–41, and assistant visiting physician, 1941–, Hartford Hospital, Hartford, Conn. Fellow American Medical Association; associate American College of Physicians; member: New England Heart Association and American Federation for Clinical Research. Diplomate American Board of Internal Medicine.

Young, Donald C., Commander (MC) USNR (*Partitioning of Barracks*, p. 885). M. D., Wayne University College of Medicine, 1925. Intern, City of Detroit Receiving Hospital, Detroit, Mich., 1925–26; Chief physician, 1926–40, and medical director, 1940–42 and 1945–46, communicable diseases division, Herman Kiefer Hospital, Detroit. Member: American Medical Association, Michigan State Medical Society, Wayne County Medical Society, and Detroit Pediatric Society.

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